The Tool Engineer

PROGRESSIVE DIES—TOOLS FOR PRODUCTION . . . PAGE 69

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

SEPTEMBER, 1952

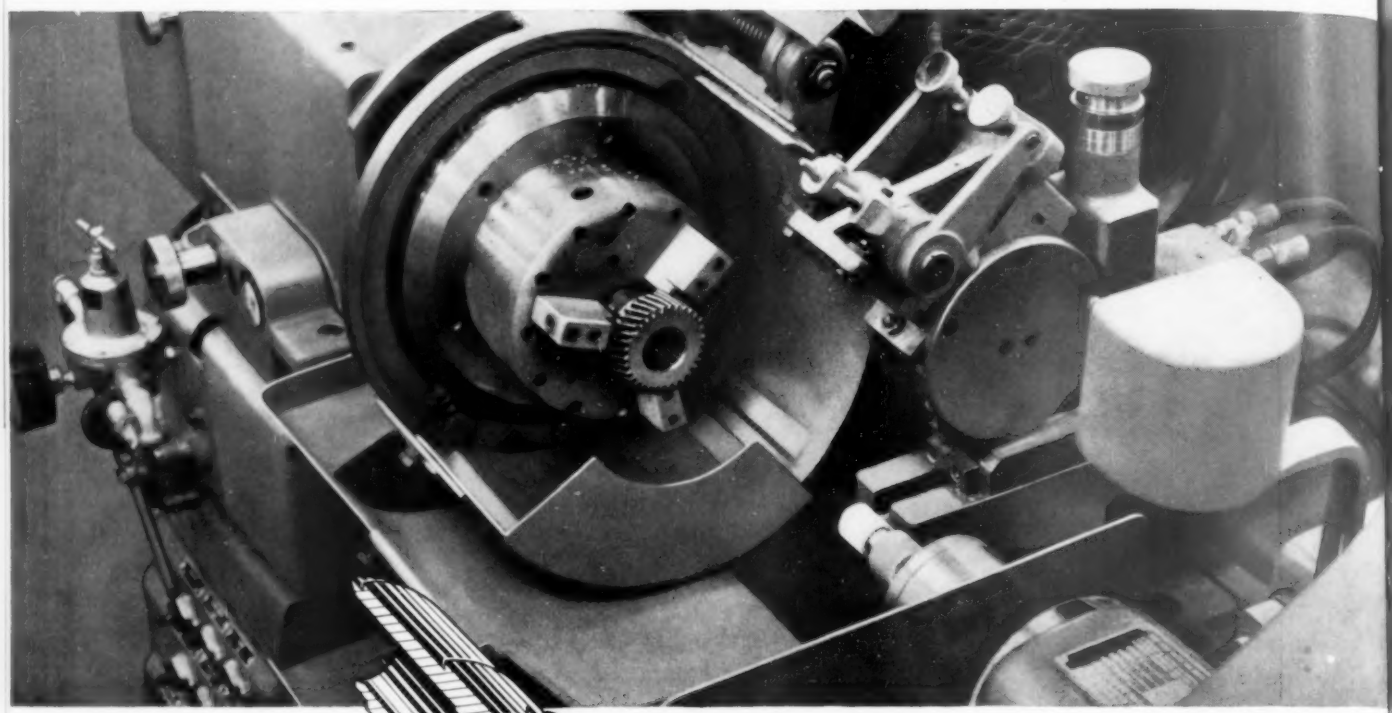
VOLUME XXIX, NO. 3

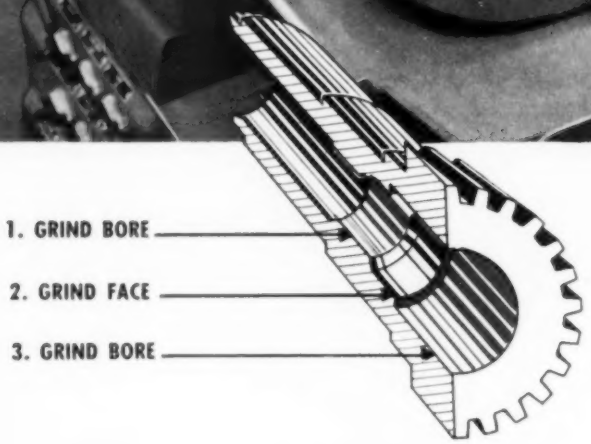
PLANNING
ENGINEERING
CONTROL

OF

TOOLING
EQUIPMENT
PRODUCTION

Here's How Heald multiplied production by making one head do multiple duty





Double wheel spindle grinds 3 surfaces at the same time

● When one machine can be equipped to perform several different operations at once, there's a big saving in time and effort — and lower cost per part, too. The Heald Model 271 Size-Matic Internal Grinder above shows how this time-saving multiplicity of operations was applied to the finishing of transmission drive sleeves.

The two different size bores and a shoulder are ground simultaneously by a double-wheel spindle, in the following high-speed automatic cycle: The table is run in and positioned by a positive stop, with spindle and wheels in the proper location for grinding. The wheelhead then cross feeds into the work, plunge grinding the bores and bottom face. Cross slide then backs off, wheels are dressed, and table runs back in for short reciprocating finish stroke in the bore.

Remember — when it comes to precision finishing, it pays to come to Heald.

HEALD

Heald machines speed the nation's production

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Branch Offices: Chicago • Cleveland • Dayton • Detroit • Indianapolis • New Yo

VOLUME XIX
NUMBER 3
SEPTEMBER, 1952

The Tool Engineer

Contents

THE TOOL ENGINEER is regularly indexed in *The Industrial Arts Index.*

AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-membrs, $6.00. Canada, $6.50; all other countries, $8.00 per year.

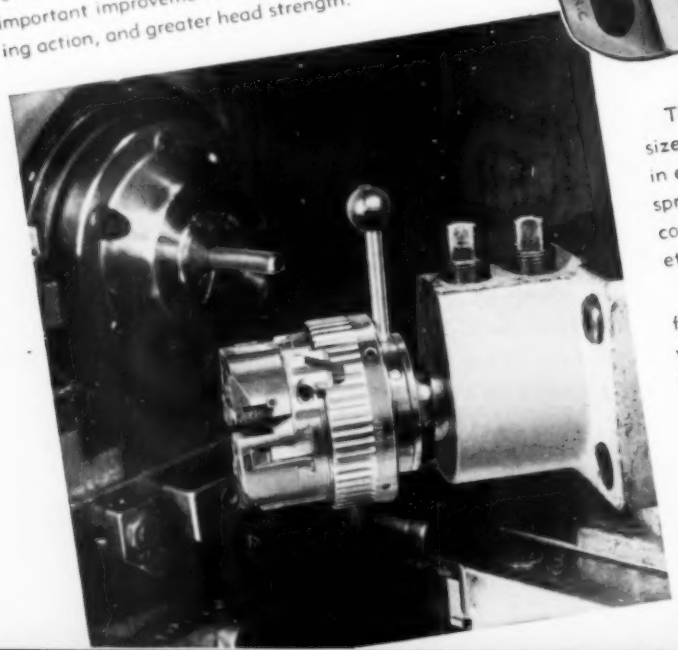
OFFICE OF PUBLICATION: 239 E. Chicago St., Milwaukee, Wis.
EXECUTIVE AND EDITORIAL OFFICES: 10700 Puritan Ave., Detroit 21, Michigan.

ANNOUNCING

The IMPROVED 5/8" LANDMATIC Head

- **POSITIVE LOCKING ACTION**
- **MORE RIGID CONSTRUCTION**

An improved **LANDMATIC** Hardened and Ground threading head has been designed for use on turret lathes, hand-operated screw machines, and automatic screw machines employing a stationary head. The 5HH **LANDMATIC** is a stationary self-opening head, and will produce threads ranging from 1/4" to 5/8" in diameter. Its construction features two important improvements in design—a positive locking action, and greater head strength.



The positive locking action is provided by a new size-adjustment mechanism. A pivoted latch is held in engagement with notches on the adjustment ring by spring tension. A movement of one notch makes a corresponding adjustment of .001" on the pitch diameter of the workpiece.

The greater overall strength of this die head results from the increased thickness of the head body and its various parts. The new design allows this small die head to easily withstand the extreme stresses imposed when threading special alloy steels.

The 5HH **LANDMATIC** Head has a notably small number of working parts. All parts are made of special alloy steel, and are hardened and precision ground. Left-hand threads may be cut by using left-hand chaser holders and regrinding the same set of chasers. More information available on request.

LANDIS *Machine* COMPANY WAYNESBORO PENNSYLVANIA

HARDINGE-SJOGREN

HARDINGE
ELMIRA, N.Y.

SPEED

Collet Chucks with HARDINGE STEEL COLLETS

Available in Five Sizes:
1", 1⅜", 1¾", 2¼", and 3½" collet capacity.

for Accuracy and Durability *at Low Cost*

When you order Hardinge-Sjogren Chucks and Hardinge Steel Collets you get all these advantages:

1. Complete Capacity for Hexagon and Square as well as Round.
2. Lowest Initial Cost.
3. Longest Service Life.
4. Grips both short and long lengths properly.

. . . . . and HARDINGE tempered steel collets assure you of quick release, sustained accuracy and durability.

Write for Bulletin 8— complete information on

HARDINGE-SJOGREN Chucks and Collets.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Cincinnati ACCURATE Shearing and Forming...

Photos —courtesy Robertson-Irwin Ltd., Hamilton, Ontario, Canada

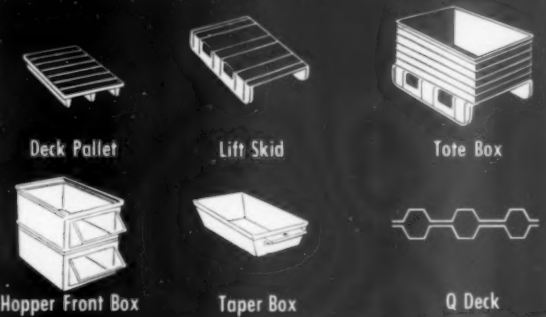
The manufacture of these quality "Tison" products for industry and farm moves smoothly, and with a certainty based on accurate shearing and forming.

Cincinnati Shears are turning out straight-sided steel blanks, accurately squared to size—which move on to Cincinnati Press Brakes for rapid, accurate forming, insuring the accurate fits necessary for the assembly operations.

It is efficient production of quality products at lowest costs—from flat sheet to finished product controlled accuracy is the story.

Write for Shear Catalog S-6 and Brake Catalog B-3, or consult our Engineering Department.

for INDUSTRIAL...



and FARM products...

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

MINOR in size yet a MAJOR new addition to STANDARD DIAL BORE GAGES

YES, Standard Gage, pioneer of dial bore gages, has developed a still newer type of dial gage for quick, accurate inspection of small diameter bores from .250" to .375". The ultimate in precision gaging of small bores, STANDARD'S No. 00 is based on an entirely new "interchangeable disc" principle, surprisingly simple in design, easy to set and easy to use.

- Readily entered in bore
- Holds its setting
- Gives positive repeat readings
- High visibility dial graduations of .0001" are easy to read

Sapphire tipped gaging plunger and chrome-plated centering-size discs insure a long, trouble-free gaging life.

NEW #00 uses centering-size discs for checking bores from 1/4" to 3/8"

★ Designed for tolerances up to .005"
★ Sapphire tipped gaging plunger
★ Chrome plated centering-size discs assure long "precision-service"

Photograph actual size

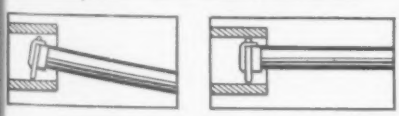
Patent Applied For

Enlarged diagram shows easy assembly of centering-size disc on plunger.

New centering-size disc

A turn of the knurled clamping nut releases centering-size disc or locks it firmly in place.

EASE OF OPERATION



Gage is entered at an angle to allow extended plunger to clear the bore, then rocked to cause plunger to pass a square position while noting minimum reading on the indicator.

When ordering be sure to state nominal size of bore and tolerance desired

EASY "SIZE CONVERSION"

Conversion to various sizes in the range from .250" to .375" is accomplished by the quick interchange of centering-size discs on the same head by the one-step operation of turning a clamping nut. Positive locking action of this nut insures holding set dimension. Centering-size discs are furnished to suit dimensions of bore to be checked. No. 00 will check to within 1/16" of the bottom of a blind hole.

Now 8 sizes cover range of 1/4" to 16" in STANDARD'S line of Dial Bore Gages.

Write for new complete Catalog C showing these and other gages.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

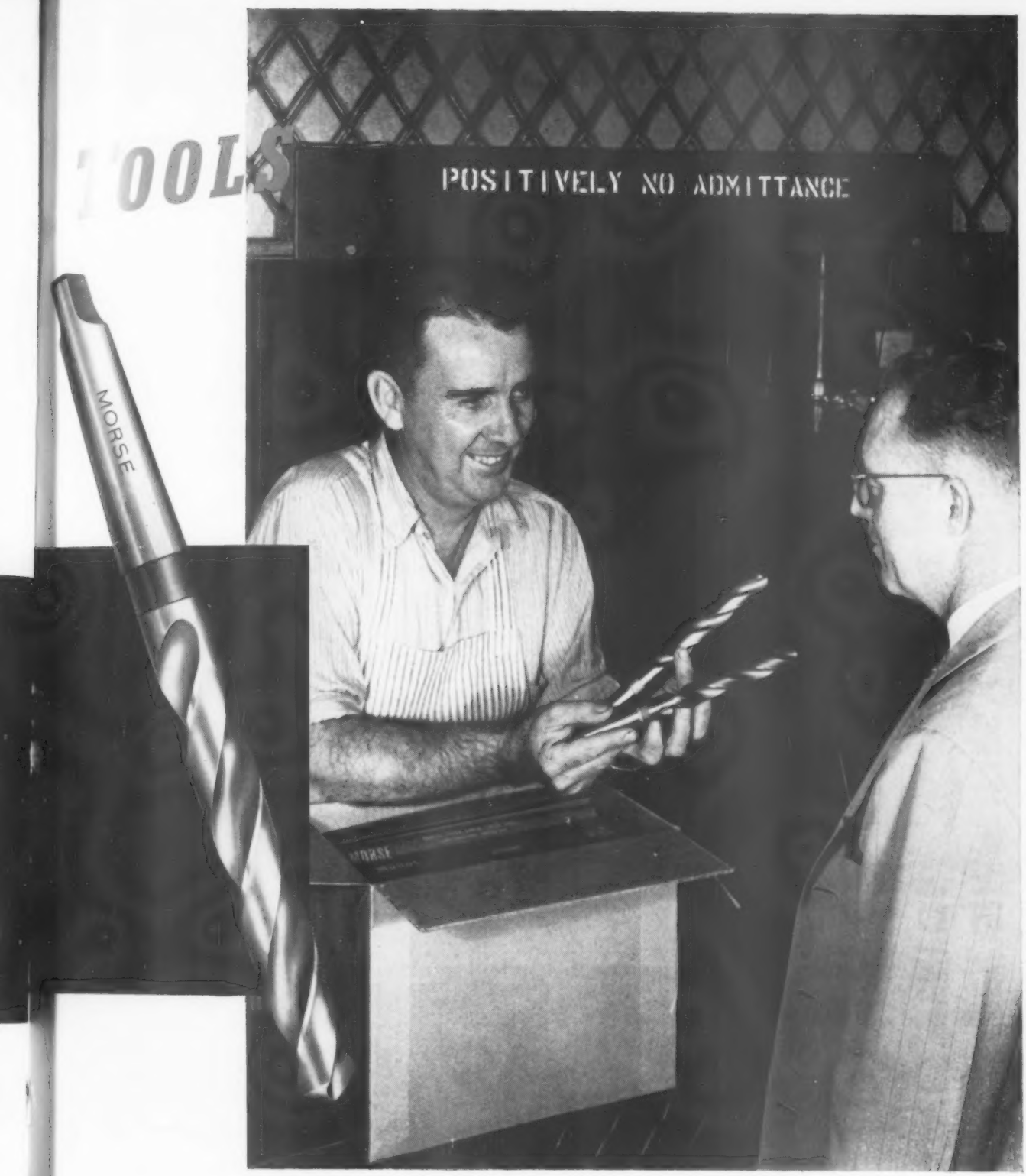
NEVER "TOO LITTLE, TOO LATE"

Your local Industrial Supply Distributor performs a valuable service to industry by stocking the sizes and types of WINTER Taps that you and his other customers are most likely to need. He is always ready to serve you—as close to your tapping problems as the telephone on your desk.

WINTER BROTHERS COMPANY
Rochester, Mich., U.S.A.

Distributors in principal cities. Branches in New York, Detroit, Chicago, Dallas, San Francisco. Division of National Twist Drill & Tool Company.

WINTER



MORSE

Cutting Tools

...buy them by phone from your Morse-Franchised Distributor and save ordering time

ALL TOP PERFORMERS ...ALL 100% INSPECTED ...ALL BUTTERFIELD!

Taps, Dies, Reamers, Screw Plates . . . and now Twist Drills . . . round out the cutting tool line that gets industry's unqualified approval for uniform accuracy and long, trouble-free service. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont. *In Canada:* Rock Island, Quebec.

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES • TWIST DRILLS

Checking pitch diameter, thread form and lead on a Zeiss Universal Measuring Microscope.

SEE YOUR NEARBY BUTTERFIELD DISTRIBUTOR FOR PROMPT DELIVERIES AND SERVICE

The wheel head tilts! on the #20 Cutter and Tool Grinder

That's why no other cutter and tool grinder does so many jobs so fast ...so easily!

FEATURING GREATLY INCREASED VERSATILITY, the Norton No. 20 Cutter and Tool Grinder brings new speed and economy to the widest range of tool and cutter grinding jobs.

The wheel head can be tilted up to 15° above or below horizontal, and swivelled through 360° — simplifying such ordinarily difficult jobs as grinding taper reamers, step counterbores, form tools and milling cutters.

Other advantages that make this Norton cutter and tool grinder easier to set up and operate include: greater lengths of table traverse and wheel slide travel . . . integral motor spindle . . . centrally located column elevating hand wheel . . . wheel slide graduated dials readable from any position . . . automatically lubricated table ways . . . electric equipment built to Machine Tool Builders' standards . . . wheel spindle reversing switch (optional) for carbide grinding.

Part of the world's most complete line of grinding machines, the No. 20 is a typical development of Norton's engineering leadership.

Remember — only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. This leadership is at your service for your present or "post emergency" problems.

Why not investigate how the No. 20 can modernize and speed up tool and cutter grinding in your plant. See your Norton Representative for detailed information — and ask him about Norton Cutter and Tool Grinders Nos. 1 and 2, and the Bura-way Grinder for automatic lathe tools. Meanwhile, write direct for Catalog 189. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

NOW YOU CAN
TOOL STEEL IN

New "GRAPH-MO HOLLOW-BAR"
longer wear of Graph-Mo with the

HERE'S big news for makers of ring gages, dies and other ring-shaped tool steel parts! A new product—"Graph-Mo Hollow-Bar"—gives you all the advantages of Graph-Mo tool steel *plus* all the advantages of a hollow bar section.

With "Graph-Mo Hollow-Bar" you can eliminate drilling, make finish boring your first step. The hole is already there. You cut machining time, reduce scrap loss, get more parts per ton of steel!

And you get all the proven advantages of Graph-Mo—a special kind of tool steel that contains free graphite and diamond-hard carbides in its structure.

User reports show that Graph-Mo outwears other tool steels an average of three to one.

Tests prove it machines 30% faster than other tool steels.

It has minimum tendency to pick up, scuff or gall.

12-year tests prove it's the most stable tool steel made.

It gives uniform response to heat treatment.

All these advantages, plus the economy of the hollow bar section, make "Graph-Mo Hollow-Bar" the big news of the year for makers of ring-shaped tool steel parts.

"Graph-Mo Hollow-Bar" comes in sizes ranging from 4" to 16" O.D. with a variety of wall thicknesses. It is distributed through A. Milne and Company and Peninsular Steel Company. And it's available in the following cities: New York, Boston, New Britain, Philadelphia, Buffalo, Pittsburgh, Cleveland, Akron, Dayton, Toledo, Detroit, Grand Rapids, Indianapolis, Chicago and San Francisco.

ADVANTAGES OF GRAPH-MO

Most stable tool steel made

Outwears others 3 to 1

PLUS

Machines 30% faster

Minimum tendency to pick up, scuff or gall

Uniform response to heat treatment

For full information on this money-saving new Timken steel product write, The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

Specialists in fine alloy steels, graphitic tool steels and seamless tubing

GET GRAPH-MO® HOLLOW BARS!

combines the faster machining and economy of a hollow bar section

ADVANTAGES OF HOLLOW BARS

No drilling

Finish boring is first step

Less machining time

Less scrap loss

More parts per ton of steel

EQUALS

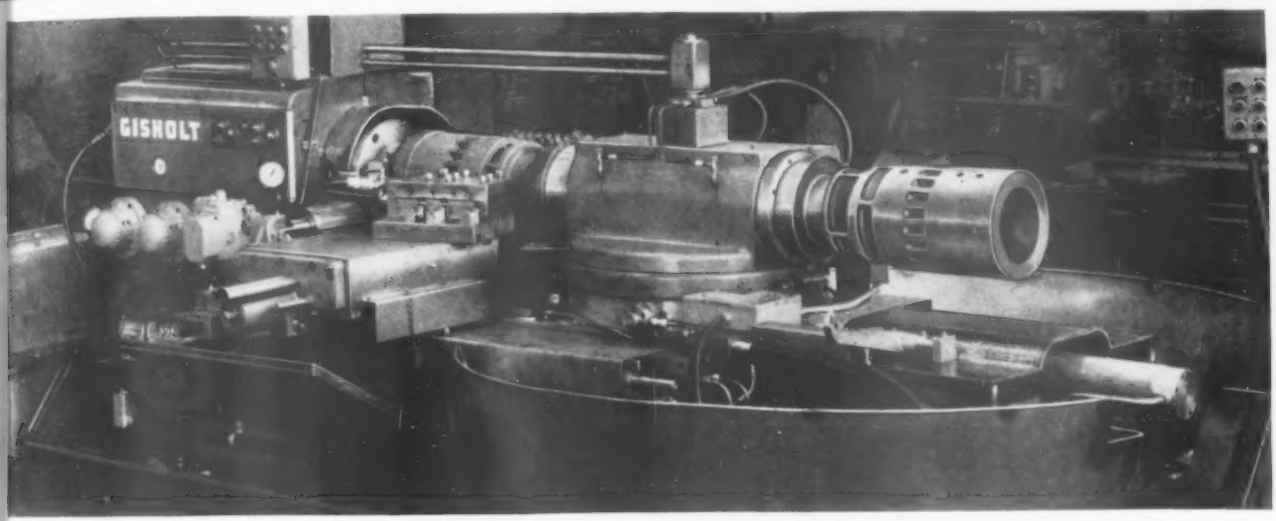
ADVANTAGES OF "GRAPH-MO HOLLOW-BAR"

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to machine shops, we hope some of these interesting ideas, culled from thousands of jobs, will suggest ways to help you cut time and costs in your own metal work.



No. 24 Hydraulic Automatic Lathe with special turret having two mandrels.

PIVOTING MANDRELS END LOADING TIME LOSS

No. 24 Hydraulic Machines One Part While Another Is Loaded

In this interesting production pointer, loading time is actually part of *machining* time—with one workpiece being put on the lathe or taken off while another is being machined.

The part is a diesel engine cast-iron cylinder liner and the machine is a No. 24 Hydraulic Automatic Lathe which has two identical expanding mandrels on an indexing carriage. Twin arbors are mounted 180° apart with ratchet teeth for driving.

Single Automatic Operation

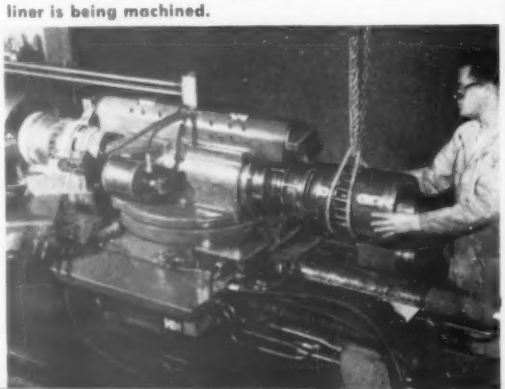
The automatic cycle begins with carriage moving forward until the arbor engages driving teeth in the spindle nose. This brings in the front and rear slides carrying a total of 28 tools which machine all outside diameters, faces and chamfers. With cuts completed, the tool slides retract, the work carriage traverses back and automatically indexes the new workpiece into position.

This feature achieves important savings in time and added production. With a finished liner being unloaded and new workpiece put in place *during* machining, loading and unloading time are absorbed in the machining cycle. Hence, the machine spends most of its time making chips. The only lapsed time between machining is for traversing up, back and for indexing—less than half a minute! Machining time for this liner—and other sizes handled on other No. 24 Hydraulics—is below 3 minutes . . . good reason why this manufacturer standardizes on the efficiency of the No. 24 Hydraulic Automatic Lathe for these operations.

With Twin Mandrels This No. 24 Hydraulic Provides Continuous, Fast Production with No Lost Loading Time.

Machined cylinder liners.

Operator loads new workpiece while another liner is being machined.



GISHOLT

TIME-SAVING IDEAS

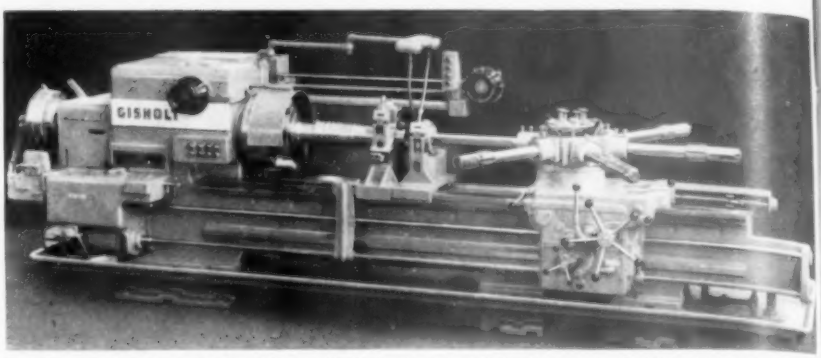
HOW THIS DIFFICULT BORING JOB BECAME AN EASY ONE . . . *MORE ACCURATE, TOO*

Saddle Type Turret Lathe Is the Answer

Here's the kind of job that qualifies as a tough one, any day. Yet see how this turret lathe takes it in stride. The part is an alloy steel propeller shaft measuring 36½"—with various inside diameters to be machined.

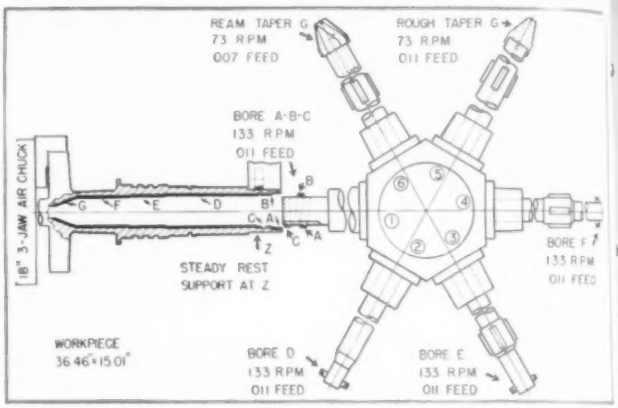
A standard 2L Saddle Type Turret Lathe is "tailored" for the assignment: In place of the side carriage there is a quick-clamping steadyrest and boring bar support. For safety and convenience, the handwheel for the Hydraulic Speed Selector and the emergency push-buttons are duplicated at the working position.

As shown in the layout, seven different internal surfaces are handled. One of these is the taper bore which is rough and finish reamed. Coolant flows through the boring bars directly on the tool bits. Floor-to-floor time with this well planned setup is 30.5 minutes with a high degree of accuracy, proving again that tough jobs can be easy ones on a Gisholt Saddle Type Turret Lathe.



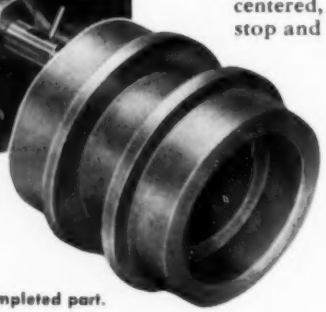
Good setup for deep boring. Note added steadyrest and boring support. Also duplicate controls.

Tooling layout for boring propeller shafts.



This Saddle Type Lathe Completes All These Difficult Interior Surfaces in One Chucking.

This close-up shows simultaneous operations on clutch part from both turrets.



Completed part.

"UTILIZING EVERYTHING BUT THE SQUEAL"

Hard Working Ram Type Lathe Setup for Clutch Parts

This job leaves nothing to be desired from the standpoint of efficiency. Everything on the lathe is busy . . . and that's good! The machine is a No. 5 Ram Type with standard hydraulic bar feed and collet chuck and its business is producing 2¼" sliding clutch shifters. Here's how it does it:

1. Stock is moved out to length and centered, using combination stock stop and starting drill.
2. Counter-bore and small bore are drilled from the hexagon turret while both hubs are turned from square turret.
3. Center recess is formed from square turret and the end is then faced from rear tool post.
4. Grinding relief is turned (both sides of center recess) from square turret.
5. Small ID is finish bored and reamed from hexagon turret.
6. Counterbore is finished from hexagon turret and cut off from square turret.

Floor to floor time is 7 minutes—with every minute of the way made easy for the operator by these Gisholt features which provide: 1. Shifts to new spindle speeds by a simple twist of the Hydraulic Speed Selector. 2. Proper spindle speed for reaming the small ID by merely tapping the Hi-Lo lever. And, 3, ease of changing feed by setting a single dial-type lever.

A Splendid Example of Well Planned Tooling and Simultaneous Machining from Both Turrets — Gives Maximum Efficiency to This Ram Type Turret Lathe Job.

GISHOLT

TIME-SAVING IDEAS

A ONE-MAN, TWO-MACHINE TEAM

Gear Blank Savings Are "Automatic"

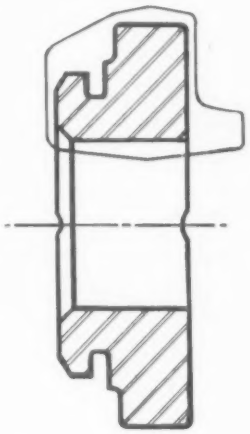
It's a case of perfect teamwork . . . the way these two 2F Fastermatic Automatic Turret Lathes turn out gear blanks. Splitting the job accounts for important savings in time, money.

First machine: With the steel forging held on the chucking hub, three passes are taken through the bore and two passes across the face, then rough turn and chamfer—all handled from the turret. Rough and finish grooving is done by tools on the independent front and rear cross slides. Time: 5 minutes.

Second machine: Part is held in the bore while turret tools remove chucking hub, semi-finish and finish the various diameters and chamfer. The two cross slides complete the rough and finish facing. Time: 3 min.

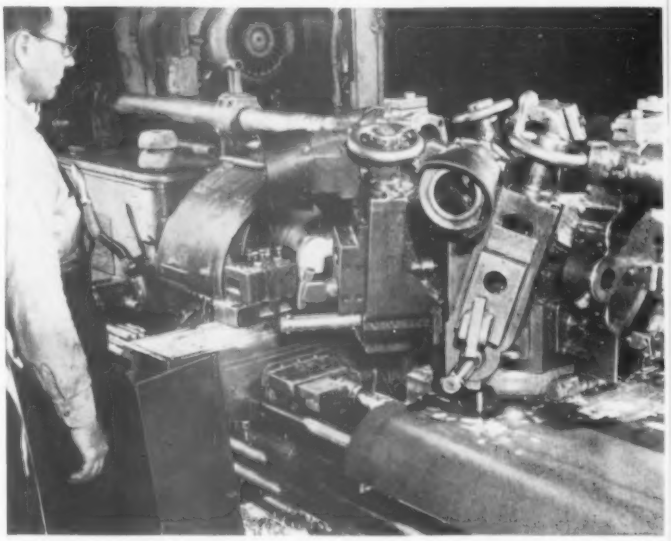
Not only is gear blank production made fast by this two-machine setup, but it's planned for real economy with one operator tending both lathes. Moreover, with the chance for human error eliminated by the automatic operation of the Fastermatics, there's assured accuracy with true concentrics and parallels.

For gear blank work—or any kind that belongs on an automatic turret lathe, investigate the Fastermatic.



Operations required to finish gear blanks. Light line indicates rough forging.

Rough forging and completed blank.



First operations on gear blanks are performed by this Fastermatic.

On This Gear Blank Job, Operator Is Needed Only for Loading and Unloading—the Two Fastermatics Automatically Perform All Work.

PUTS FINISHING TOUCHES TO CRANKSHAFTS — *BUT FAST*

Simplimatic Does Neat Job on Counterweights

Crankshafts always make interesting machining jobs. On this one, for a V-8 engine, a Simplimatic Automatic Lathe takes care of the six counterweights. Here's the setup:

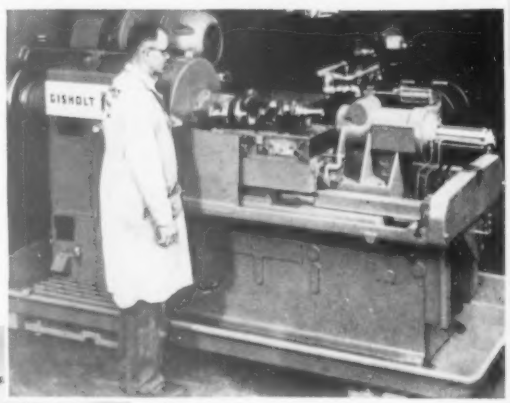
The 25½" crankshaft is held in a special pot-type chuck and driven from a slot in the flange. The oil seal bearing surface rests in a half bearing and is clamped with two jaws. There's a steadyrest at number three main bearing for support. Number one main bearing is held in a tapered, slip-fit bushing in the tailstock.

Three tools each in both the front and rear slides turn all six counterweights and generate chamfers ⅛" by 45 degrees. Floor to floor time is 1.66 minutes, using H. S. S. cutting tools. The sliding tool holders, a precautionary feature for this job, retract into master blocks after cycle is completed, thereby providing loading clearance and tool protection.

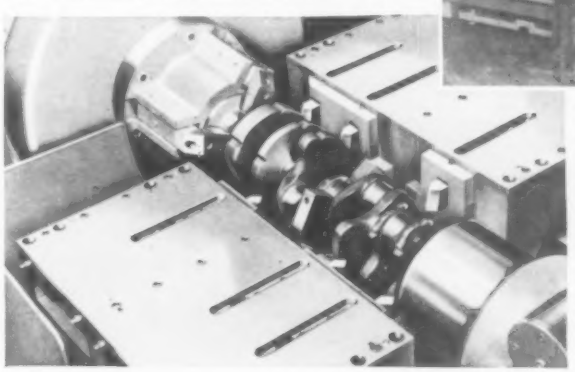
All Crankshaft Counterweights Are Turned and Beveled in a Single Automatic Operation by the Simplimatic.

JUST OFF THE PRESS!

An entirely new Simplimatic catalog is ready—complete with the information and specifications you want, pictures and job facts. Write today!



The Simplimatic with part ready for loading. Tool blocks at this point are retracted for clearance and tool protection.



Close-up of the workpiece and tooling. Note steadyrest for center main bearing.

GISHOLT

GISHOLT

TIME-SAVING IDEAS

HOW MAINTENANCE BALANCING PAYS FOR ITSELF

Southern Railway Company Adds Life to Diesel-Electric Equipment

Southern Railway Company is doing it, too. In its Pegram Repair Shop, Atlanta, they are getting even greater efficiency and performance from diesel electric locomotives—through balancing. A 6U DYNETRIC Balancer handles balancing in the maintenance of traction motors and generator armatures.

An example is this traction motor armature. Measuring 4 feet long and weighing 2500 lbs., dynamic unbalance is located and measured to an accuracy of ¼ ounce inch. Corrections are made by welding small steel blocks on the core while the armature is still in the balancing machine. A final check for accuracy and possible operator error is then made.

On this large electrical part, the entire operation—setup, loading, checking, correcting, rechecking and unloading—only requires about one hour. Yet, this accuracy of balance—with smoother, vibrationless operation and lessened bearing wear—pays off in far longer life between overhauls, returning balancing costs many times over.

If maintenance of electrical equipment is a problem of yours, ask for the article on balancing applications in railway shops. With it we will include the book *Static and Dynamic Balance*, which thoroughly covers the entire field of balancing.

ALL MATTERS OF BALANCING, *maintenance and production balancing are covered fully in the Gisholt Balancing School. Write for details, starting dates.*

Ready to check and correct unbalance in 2500 lb. armature.

Dial indicates exact number of correction units required.

Precision Balancing of Railway Electrical Equipment Greatly Reduces Frequency of Failure and Assures More Efficient Operation.

DYNETRIC BALANCERS — GISHOLT — DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

THE WAY TO BETTER CRANKSHAFTS—SUPERFINISH

Versatile Machine Handles Variety of Sizes

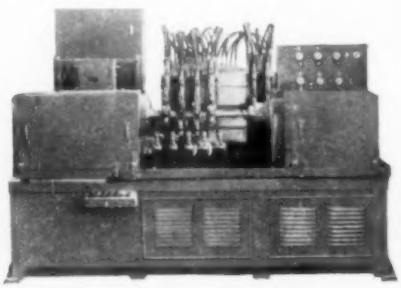
Even on diesel engine crankshafts, Superfinishing is a quick, inexpensive process.

This Superfinisher is a Model 77, arranged to do both pin and main bearings on a variety of 4 and 6 throw crankshafts. Four sets of stones in each of the upper stoneholder assemblies handle the pin bearings. Lower assemblies each have two sets of stones for the main bearings.

Crankshafts come to the Superfinisher with rough ground bearing surfaces of 20-30 micro inches. After a 2.3 minute automatic cycle, surfaces measure 4-5 micro inches. What this finer smoothness means in greater crankshaft performance is obvious—grinding chatter marks and smear metal are removed, there's improved geometry, added smoothness and longer bearing life.

See how your own problems can be solved by Superfinishing. Write for your complimentary copy of *"Wear and Surface Finish."*

Superfinishing These Crankshaft Bearings Not Only Assures Longer Lasting Surfaces, but It Also Cuts Grinding Time and Costs.



Model 77 Superfinisher for 4 and 6 throw crankshafts.

Close-up showing upper and lower stoneholder assemblies for Superfinishing pin and main bearing simultaneously.

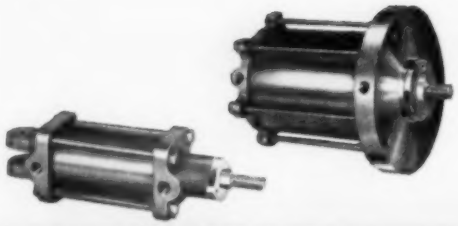
No. 9-1052

599

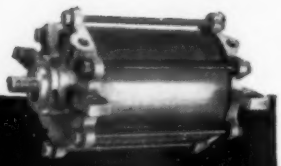
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Pneumatic Cylinders



Really complete, the Hannifin line of pneumatic cylinders is made with two types of pistons . . . bores from 1″ to 16″ . . . six standard mountings. Really standard, these cylinders are tooled to tolerances that assure accurate mounting to make assembly to your machines easier. Really built, each cylinder is "TRU-BORED" and honed, piston rods are ground and polished, interchangeable end caps, heavy duty tie rods . . . rugged, yet precision construction throughout!

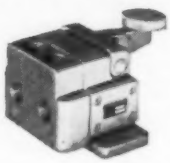
Write for Bulletin 210

NOW...

HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

Disc Type Air Control Valves

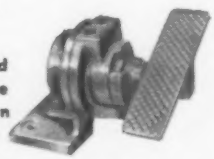
Sliding disc type air-operated valves (Provide effortless hand or foot control)



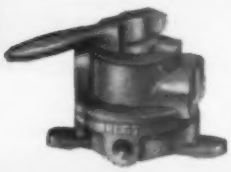
Designed for smooth, positive and accurate control of air-operated equipment. Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation. Sizes from ⅛″ to 1¼″ I.P.S.

Write for Bulletin 57-W

Hannifin "Directair" electrically controlled air-operated disc valve

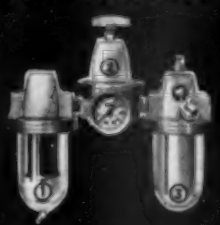


Foot-operated treadle valve (Also spring return and rotary types)



Standard hand control valve (Single or duplex)

AIR WARDEN



Hannifin "Air Warden" units are the finest protection possible for air-operated equipment. Complete units include: (1) Air Filter which removes grit, dirt, scale, moisture, emulsified oil; (2) Self-Bleeding Pressure Regulator that assures absolute stability of secondary pressure; and (3) Atomizing Type Lubricator fillable without shutting off air pressure. Components also sold separately. Write for Bulletin 1010B

do ALL you CAN do... with

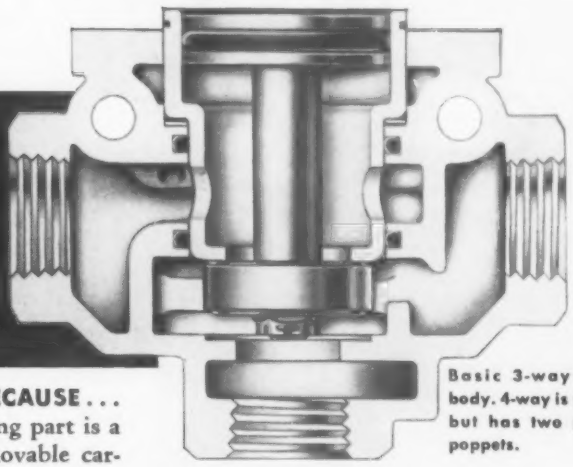
HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

PLUS... A Line of Valves Every Maintenance Man Will Appreciate!

NEW HANNIFIN *P-M* *Pilot-Master Valves*



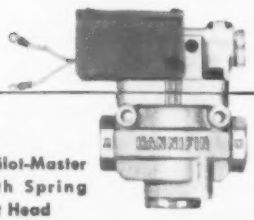
Basic 3-way valve body. 4-way is similar but has two piston poppets.

THIS NEW DESIGN REDUCES DOWN TIME, BECAUSE... there are no springs in the main valve... only moving part is a piston-poppet assembly which fits in an easily removable cartridge, replaceable without disturbing line connections. Besides, in the entire line, there are only two body designs, one for 2-way and 3-way, another for 4-way. The basic 3-way valve operates either 2-way or 3-way, normally open or normally closed, without any internal change whatever. Interchangeable heads give choice of pneumatic or electric control. What all this means is fewer valves to stock, fewer parts to stock, less time lost replacing valves, parts, or control heads.

- **Fewer Valves to Stock**
- **Fewer Parts to Stock**
- **Maximum Interchangeability**
- **No Springs in Main Valve**

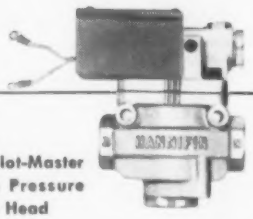
Three Types of Head Fit One Body

(Top flanges are same size for every body size, ⅜" to 1¼" I.P.S.)



SERIES B-2 Solenoid Pilot-Master Valve with Spring Return Pilot Head

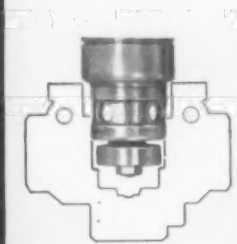
SERIES B-1 Master Valve with Plain Head for Remote Control



SERIES B-3 Solenoid Pilot-Master Valve with Pressure Return Pilot Head

features you find in no other valves, compare!

New cartridge design—instantaneous operation, provides speeds to 600 cycles per minute—continuously rated, low amperage solenoids, positively mounted—full pipe capacity—pressure range from 15 to 150 P.S.I.—corrosion resistant throughout—will operate on liquids as well as air—choice of 10 Pilot Valves, ¼" I.P.S., for remote control of Master Valves.



Exclusive Replaceable Cartridge

Contains every moving part of Master Valve. Two sizes fit all 5 valve sizes. Easily replaced without disturbing main piping connections.

Write for the Complete Story

Get it today!

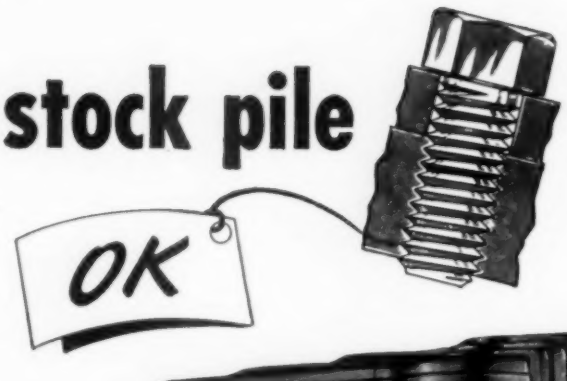
Bulletin 231. Shows and tells all about the new Hannifin P-M line... Pilot Valves, Master Valves, Pilot-Master Valves... 2-way, 3-way, 4-way.

HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

stock pile or scrap pile



IT'S THE FINAL OPERATION THAT CAN MEAN THE DIFFERENCE

Your Warner & Swasey Field Representative will be glad to show you how a Precision Tapping & Threading Machine can increase production and cut scrap loss in your shop.

PRECISION tapping and threading is often the final step in finishing a piece that has undergone many previous machining operations. Here is where inaccurate fits or thread errors can mean costly scrap loss, and upset your production schedules.

Warner & Swasey Precision Tapping & Threading Machines drastically reduce these wasteful rejects. These machines feature a radically different and exclusive leading-on principle, with solenoid-actuated guide fingers operating on a lead screw. This provides positive control on tapping and retracting strokes, completely eliminating backlash or drag. A super-sensitive clutch, adjustable to safe torsional resistance, stops the tapping operation immediately when the tap hits a hard spot or chip accumulations, saving spoiled threads or broken taps. Precision depth control assures depth accuracy to within $\frac{1}{10}$th of a revolution of the tap or die.

These and other special features insure fast, extremely accurate tapping to Class 3 or 4 gage fits in a wide range of materials—from tool steel to plastics.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS, AND TAPPING MACHINES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-24

Is your present abrasive method

Only CARBO

TRADE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York

really good enough, today?

Chances are good that if you've been using the same method for a mere two years, there's now a better way. That's how thick and fast the new developments in abrasive techniques have come along. Every day someone, somewhere, is switching from one method to another, under the pressure of one hard economic fact: the need to cut costs.

Here lies the biggest advantage to the shop which has standardized on abrasives by CARBORUNDUM. You get counsel free from bias, for the CARBORUNDUM distributor or salesman represents the only producer of a complete branded abrasives line, famous for uniform high quality. Thus he can recommend on the basis of what's most profitable for you, not just what's most profitable for him. And he can keep you posted on all the newest practices of metalworking shops from coast to coast.

Make a mental run-down today of each abrasive operation your shop performs, then call in the man from CARBORUNDUM for his experienced, practical, unbiased counsel. You'll find him listed in the yellow pages under "Abrasives." Call him today—it's to your profit!

Here are only a few of the 30,000 reasons why you get the RIGHT combination of abrasive and method only from CARBORUNDUM

RUNDUM

MARK

offers ALL abrasive products...to give you the proper ONE

RUGGED, LOW COST AIR CYLINDER WITH BUILT-IN VALVE SETS NEW STANDARDS FOR FAST, PRECISION OPERATIONS

Built-in electrical operating controls, built-in 4-way valve, built-in dual piston rod speed regulators, all with a single air connection, simplify installation of economical pneumatic circuits.

Any repetitive push, pull or lift movement now done manually can be performed infinitely faster, safer, and at lower cost with this unique, electrically-controlled Bellows Air Motor. The range of work it can do is limited only by the imagination of the tool designer or production engineer.

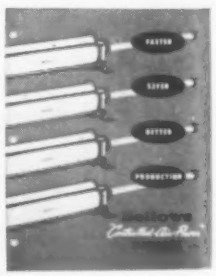
Unlike conventional air cylinders which require separate remote valves and cumbersome piping, The Bellows Air Motor is a complete power unit. It is compact, fits into crowded quarters, on moving machine elements. It is fast, responds to a starting impulse instantly. It is safe. Its low voltage operation simplifies wiring. It is sturdy, records of 10,000,000, 15,000,000, even 30,000,000 cycles without maintenance or repairs are commonplace.

The Bellows Air Motor is made in a wide range of mounting styles; in five bore sizes to meet varying power requirements; and in standard stroke lengths up to 48". For mechanical or manual operation the Air Motor can be equipped with a built-in manual valve, or for operation in explosive-hazardous areas with the built-in explosion-proof electrically controlled valve.

The Bellows Air Motor gives you an entirely new conception of the productive possibilities of air power. In the thousands of manufacturing plants where it is in use, it is establishing daily new records for cost reduction and improved productive efficiency. In metal working, in plastics, in woodworking, in any industry you can name, these versatile power units are sparking the imagination of cost conscious production men looking for ways to do old and new jobs better.

WRITE FOR THIS FREE 32-PAGE BOOKLET

HERE IN THESE QUICK-READING PAGES IS THE STORY OF "CONTROLLED-AIR-POWER" — WHAT IT IS DOING FOR OTHERS — WHAT IT CAN DO FOR YOU. THERE IS NO COST, NO OBLIGATION. ADDRESS: DEPT. TE-952, THE BELLOWS CO., BELLOWS BLDG., AKRON 9, OHIO. ASK FOR BULLETIN CL-30.

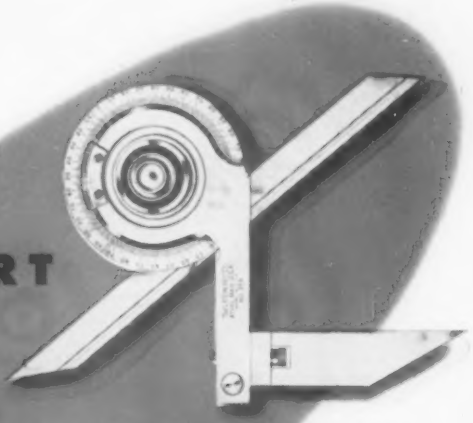


The Bellows Co.
AKRON 9, OHIO

1464

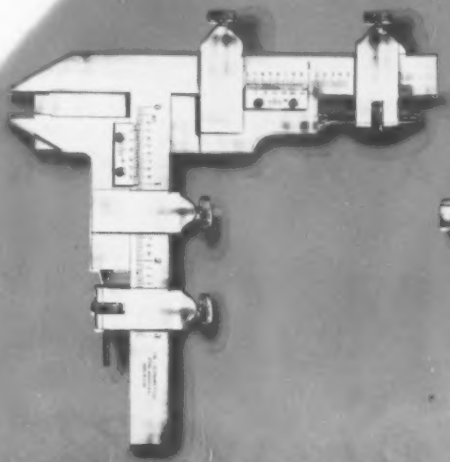
BELLOWS "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION

FINEST EXAMPLE OF THE TOOLMAKER'S ART

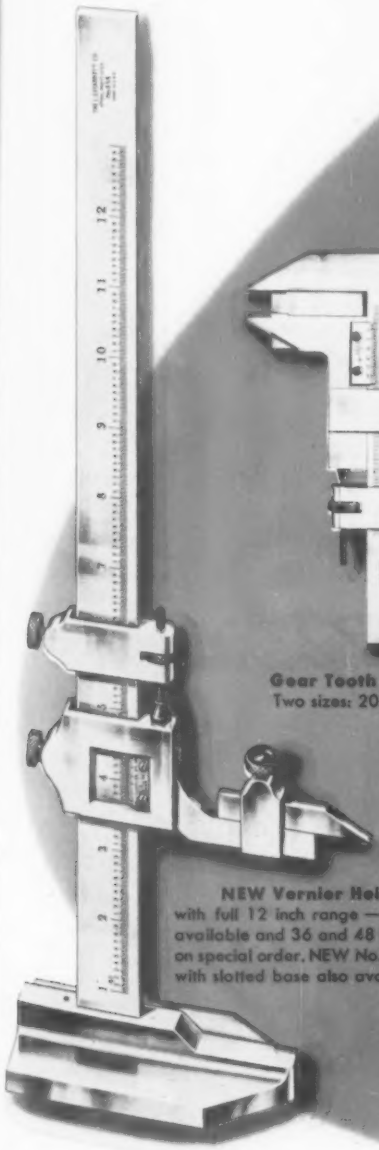


Universal Bevel Protractor No. 359
With fine adjustment and acute angle attachment.

Vernier Depth Gage No. 448
6 and 12 inch ranges.

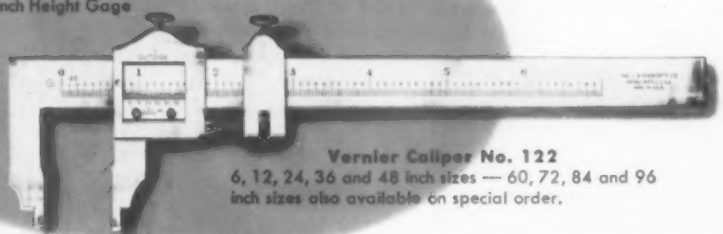


Gear Tooth Vernier Caliper No. 456
Two sizes: 20-2 and 10-1 diametral pitch.



NEW Vernier Height Gage No. 454
with full 12 inch range — 18 and 24 inch sizes also available and 36 and 48 inch gages can be furnished on special order. NEW No. 354 — 6 inch Height Gage with slotted base also available.

Starrett Vernier Gages give skilled hands the added precision that means both speed and accuracy. Preferred throughout industry for perfect balance, sharp easy-to-read markings, latest design features. Buy for the shop the tools your men choose for themselves — STARRETT TOOLS. Look to your Industrial Distributor for prompt, dependable, quality service.



Vernier Caliper No. 122
6, 12, 24, 36 and 48 inch sizes — 60, 72, 84 and 96 inch sizes also available on special order.

VISIT THE STARRETT EXHIBIT BOOTH 1843—National Metal Congress and Exposition Philadelphia, October 20-24

STARRETT TOOLS

TRADE MARK
Starrett
REG U.S. PAT. OFF.

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.

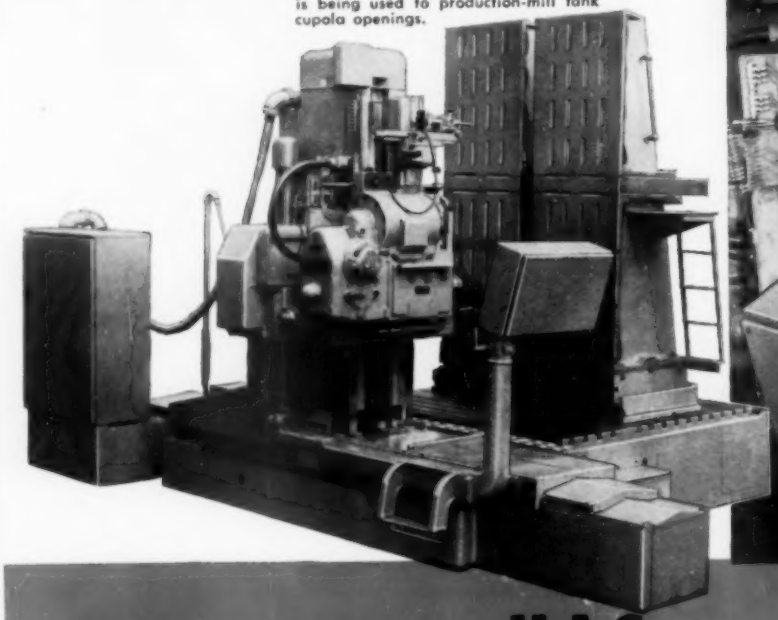
MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR

- *Prompt delivery*
- *Dependable service*
- *Quality products*

TYPE
BG-21

Made with work capacities ranging from 5 feet to 10 feet horizontally and 2½ feet to 4 feet vertically, in single spindle and two-spindle types, this latest model in the KELLER line incorporates all the advanced features of the larger Type BG-22. In this KELLERING operation, profiling control is being used to production-mill tank cupola openings.



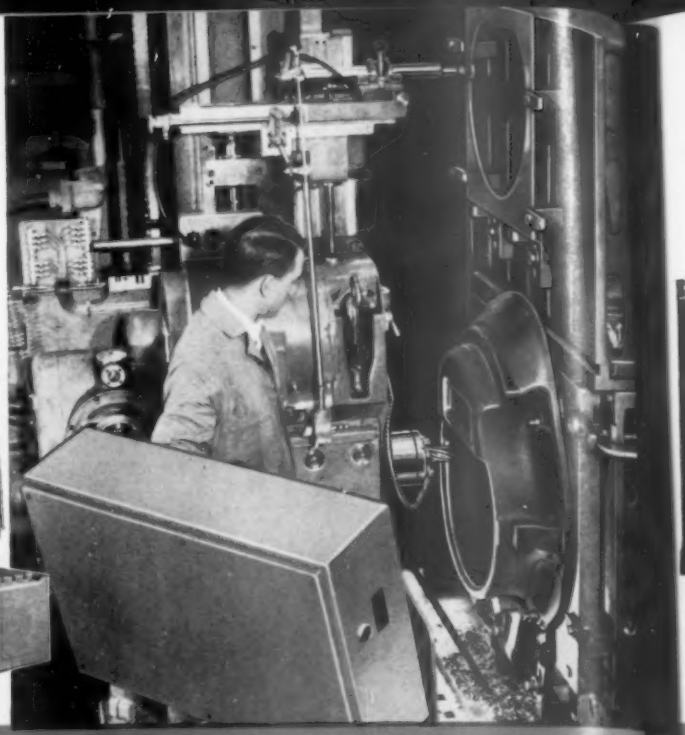


PHOTO COURTESY E. D. JONES & SONS CO., PITTSFIELD, MASS.

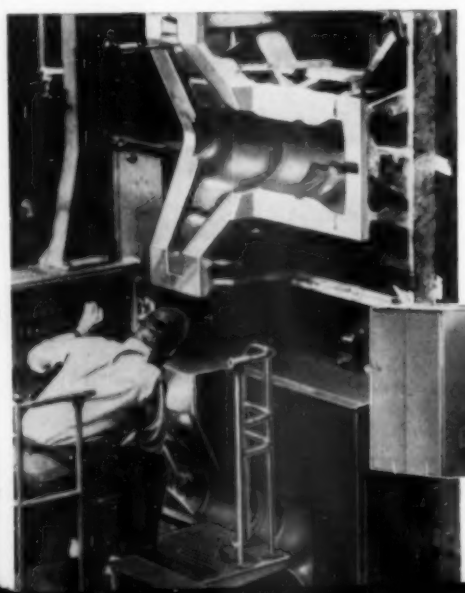
INDUSTRY **HAS** A WORD FOR IT . . .

KELLERING

Fast, Accurate, Economical Reproduction

TYPE
BG-22

Largest in the KELLER line, the huge BG-22 is made with work capacities ranging from 10 feet to 20 feet horizontally and 5 feet to 7 feet vertically, in single spindle and three-spindle types. Widely used in the automotive industry, it is shown here KELLERING a forging die for a non-ferrous press forging for the aircraft industry.



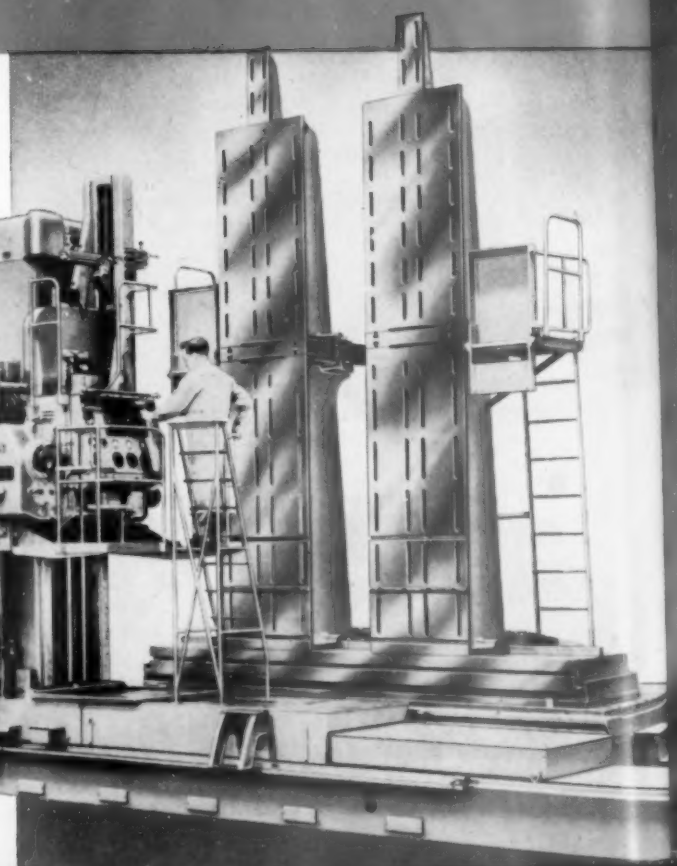


PHOTO COURTESY
WYMAN-GORDON CO.

PE
BL

Designed specifically to handle the smaller jobs economically and efficiently, the Type BL is made in two sizes for work areas of 24" x 16" and 36" x 20". A three-spindle machine is also made for the production manufacturing of small parts. The photo at right shows a single spindle machine cutting a precision die casting die in steel from a wood master.

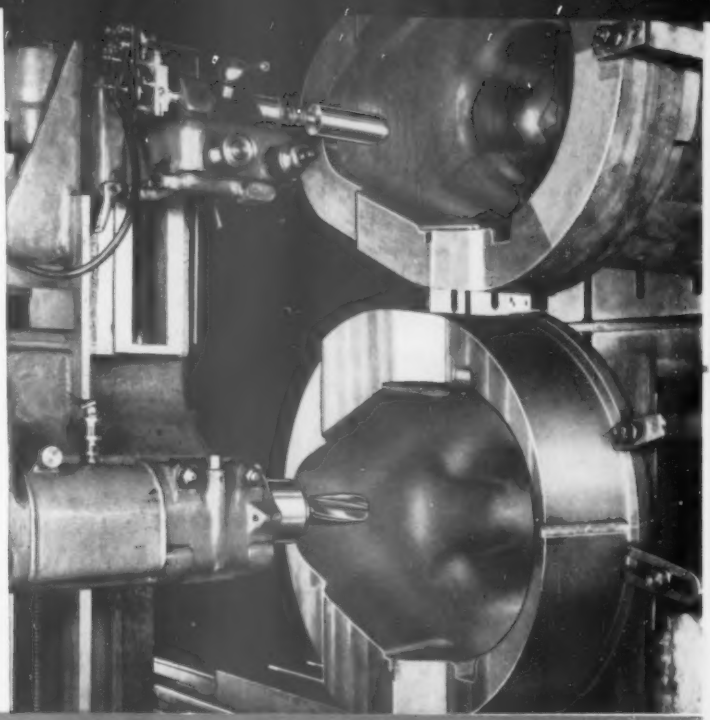


PHOTO COURTESY STERLING ENGINEERING CORP., WINSTED, CONN.

with PRATT & WHITNEY KELLER MACHINES

Automatic Tracer-Controlled Milling

Experience gained during nearly 40 years of designing and building tracer-controlled milling machines combined with Pratt & Whitney's over 90 years of manufacturing precision tools has made the P&W-KELLER Machine the finest of its kind ever produced. It has become so basic and so popular in industry that this type of machining is now universally known as "KELLERING".

Pratt & Whitney-KELLER Machines are powerful, horizontal spindle millers controlled by an electric tracer. They faithfully reproduce the shape of any 2- or 3-dimensional master form or pattern. Very complicated shapes are duplicated as economically as simple work. Designed specifically for tracer-controlled milling, KELLER Machines are unequalled for speed and accuracy, total machining time is much less than that required by any other method, and a minimum of hand finishing is needed. In the production of dies, molds, punches and in many other duplication jobs, you can look to P&W-KELLER Machines for new standards of speed, accuracy, convenience and economy. A complete line, with a wide range of work capacities, makes any job the right size for "KELLERING".

Write on your Company letterhead for fully descriptive KELLER Bulletin No. 490-2 for the smaller work sizes or Bulletin No. 537 for large work.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

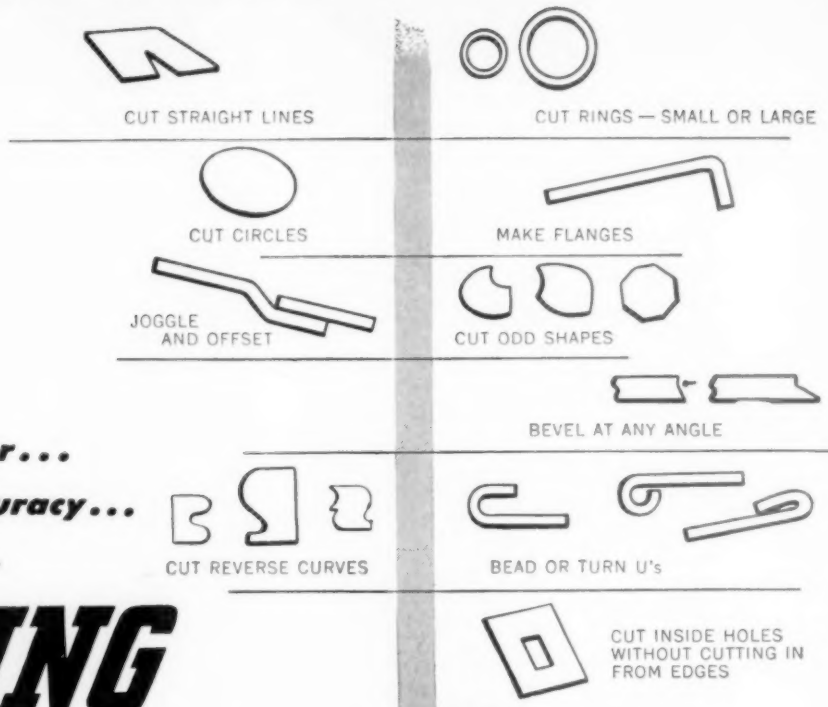
No. 537 No. 490-2

First Choice for Accuracy

Branch Offices . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.)
LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

UTTING TOOLS • GAGES • MACHINE TOOLS

if you do One or More of these Jobs...



do them faster...

with more accuracy...

at a lower cost...

***with* KLING**

ROTARY SHEARS

Now get hair-line precision as well as speed in all of your sheet and plate cutting. With Kling Rotary Shears, no matter what your shearing requirements, you improve both speed and accuracy. You get accuracy unheard of before in shearing operations. You get speed that will keep pace with today's production demands.

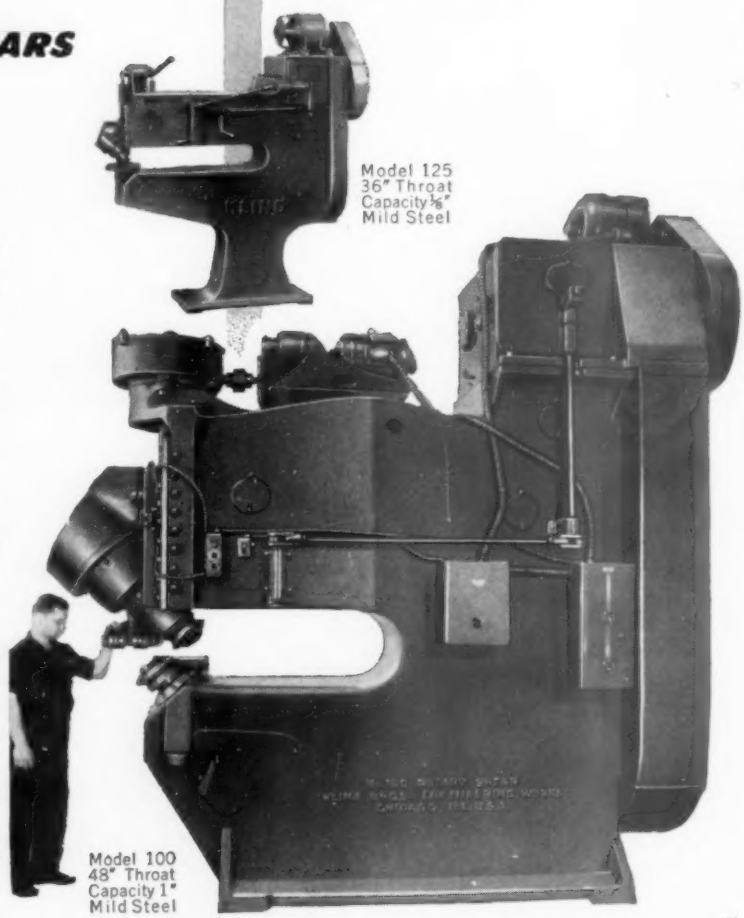
You get this money-saving performance whether you do one or many of the operations shown above. One Kling Shear, because of its versatility, will often eliminate the need of several old style shears or other types of equipment.

Many attachments are available which permit this machine to perform a wide variety of functions. With Kling Shears it is possible to shear almost any shape desired including parts with very small radii, to the right or left.

A wide range of types and sizes are available to meet your specific requirements up to a rated capacity to shear 1" thick mild steel.

get the facts . . . Find out how this machine will fit your production requirements and save you money. For complete details, instructions, features and specifications of all Kling Rotary Shears, write today for your free copy of Kling Bulletin No. 245A.

Kling Bros. Engineering Works,
1321 N. Kostner Avenue, Chicago 51, Illinois



Kling ***...an investment in speed!***

5677-R

The Tool Engineer

Editorial

The Responsibility of Citizenship

Most of us are serious about our citizenship. Being a citizen during these days is a more serious business than it used to be. In its progressive development, our Country has accumulated greater responsibilities both to its own people and to the rest of the world. Many of these responsibilities are extremely complex, sometimes difficult for the average citizen to comprehend.

The orator who incites the return to the principles of austerity and self-sacrifice is not in popular demand today. Better received is the silver-tongued speaker who exhorts the doctrine of "giving all" with nothing expected in return, and mortgaging the present to the generations of the future. "Deficit financing," "inflation," "spiralling costs," etc. are only a few of the more common terms in use today which would have flabbergasted folks at the turn of the century.

Change is the essence of progress—be it for better or for worse. Change for the better naturally is desired. The broad problem facing the world today is, "What changes will be for the better?" The individual who takes his citizenship seriously has the prerogative of playing an all important part in the answer to this question.

Good citizenship has its responsibilities. Primarily, they consist of an active interest in what is taking place, an understanding of the problems, clear thinking, decision, and unadulterated concept of what is right.

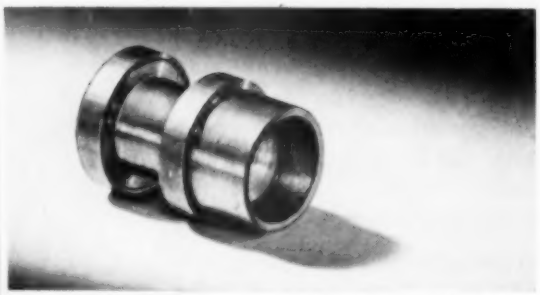
The retention of the individual's freedom, as granted and guaranteed in the Declaration of Independence, is essential.

Citizenship is EVERYBODY'S business!

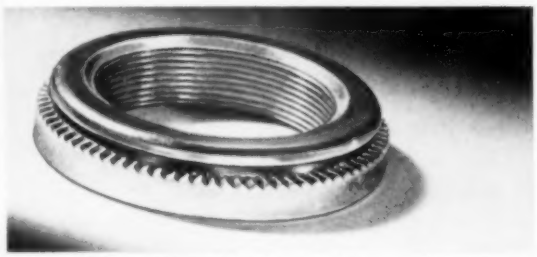
L. B. Bellamy

PRESIDENT
1952-1953

LOCK CYLINDER. Metal: 1¾" dia. brass • Machine: model 601 New Britain Gridley • Operations: *cross slide*—rough form, finish form, break down cut off, side mill, vertical end mill, final cut off; *tool slide*—face, drill offset hole, ream and counterbore offset hole, thread • Spindle Speed: 1,324 rpm • Feed: .006" per revolution • Tools: high-speed steel • Cycle Time: 7.3 seconds



CARPENTER'S PLANE PART. Metal: ⅜" B1113 steel • Machine: Brown & Sharpe Automatic Screw Machine • Operations: *front cross slide*—form; *rear cross slide*—cut off; *turret*—feed stock, spot drill, drill 13/32" hole, tap drill, reverse spindle and tap left-hand thread • Spindle Speed: 1,180 rpm • Feed: .0025" per revolution • Tools: high-speed steel • Cycle Time: 30 seconds



KNOB INSERT. Metal: 1⅜" round aluminum • Machine: model 61 1⅝" New Britain Gridley • Operations: *cross slide*—form, knurl, cut off; *tool slide*—spot drill, tap, ream, recess • Spindle Speed: 1,600 rpm • Feed: .005" per revolution • Tools: high-speed steel • Cycle Time: 7 seconds

SUN OIL COMPANY, Dept. TE-9
Philadelphia 3, Pa.

I am having trouble possibly caused by an inadequate cutting oil. I would like ☐ the services of a Sun representative; ☐ the booklet "Cutting and Grinding Facts."

Name _____

Title _____

Company _____

Street _____

City _____ Zone _____ State _____

MORE THAN 300 PARTS ARE MACHINED with the aid of *one* cutting oil for tools and hardware items made by Sargent & Co. Raw materials worked are: B1113 steel, 11ST-3 aluminum, ASTM-B140-46 Type B half-hard bronze, B16-46 brass, and Type 416 stainless steel. Stock ranges from 1/16" wire to 2" bars.

SINGLE GRADE OF SUNICUT REPLACES 4 CUTTING OILS

A good example of cutting-oil economy and efficiency is provided by Sargent & Co., well-known hardware and tool manufacturers. Their complete line requires the machining of more than 300 parts from a wide range of metals. A few years ago this company was using four different cutting oils, purchased in drums. By switching to a single product, Sunicut 11W, and buying it in bulk, Sargent has been able to effect an annual saving of about $3,000. All operations are performed as well as before, or better—and shop efficiency is up.

Sunicut 11W is a low-viscosity, dual-purpose cutting oil for automatics machining all nonferrous metals and free-machining steels such as B1112 or B1113. Its transparency permits quick and accurate miking. It will not stain brass or copper under normal conditions. It drains rapidly, minimizing carry-off. And its high lubricating and cooling properties aid in prolonging tool life and improving finishes. Moreover, it protects finished parts from rust and corrosion.

Other Sun cutting oils offer similar opportunities for improved operations and economy. For information about them, or the help of a Sun representative, use the coupon at the right.

SUN INDUSTRIAL PRODUCTS
SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO & MONTREAL

SUNOCO

Har[illegible] E. Conrad
Executive Secretary
Alla[illegible] Ray Putnam
Assistant Executive Secretary

Editorial

Robert T. Kimmel
Associate Editor
Nancy L. Morgan
A.S.T.E. News Editor
Robert Steiger
Art Editor
Dorothy J. Taylor
Assistant Editor

Business

Allan Ray Putnam
Business Manager
Clarence T. Etter
Advertising Manager
10700 Puritan Ave.
Detroit 21,
Michigan
Austin G. Cragg
Eastern Advertising Manager
400 Madison Avenue
New York 17,
New York
Richard E. Cleary
Ohio Advertising Manager
Commercial Bank
Building
Berea, Ohio
Stanley F. Girard
Western Advertising Manager
540 North Michigan
Avenue
Chicago 11, Illinois
W. R. McIntyre
Pacific Coast Advertising Representative
423 First Trust
Building
Pasadena 1, California
Michael Jakesy
Production Manager
Fay H. LaRoue
Circulation Manager

THE TOOL
ENGINEER
Publication of The
American Society of
Tool Engineers
10700 Puritan Ave.
Detroit 21, Mich.

The Tool Engineer

a letter from the Editor

The back-of-the-book section of *The Tool Engineer* which includes the departments such as Tools of Today, News in Metalworking, Technical Shorts and Trade Literature is one of the better read sections of the magazine if the number of reader service cards returned is any indication. Last year more than 25,000 of these cards were returned to the magazine requesting further information on some subject featured in these columns or in the advertisements. The sum total of this demand for information is staggering when considered in the aggregate.

However, broken down into individual requests, each query represents a reader who has found something in these pages that suggests a better, a quicker, or an easier method for dealing with his own particular problems.

This reader response is most gratifying and the staff of the magazine makes every effort to see that each reader is supplied with the material he desires. The requests for literature are forwarded to manufacturers promptly. The other questions are answered by one of the staff, or are referred to competent authorities in the field concerned. While we can't pretend to be consulting engineers equipped to answer questions on any subject, we can and do serve an important function in putting the reader in touch with someone who does know the answers.

Robert T. Kimmel

ASSOCIATE EDITOR

Latrobe

Invites comparison

- of standard process tool steels with *"Desegatized"*®* quality.
- If you are not using *"Desegatized"* Steels, Latrobe offers you a simple, yet convincing, method of checking the steels you are using against *"Desegatized"* quality.
- Ask your Latrobe representative for details.

*ALL LATROBE HIGH SPEED STEELS AND HIGH CARBON—HIGH CHROMIUM DIE STEELS ARE FURNISHED AS *"Desegatized"* MATERIAL.

Latrobe Steel Company, Latrobe, Pa.

Sole Producers of "Desegatized" Steels

Automatic Size Control in Finish Grinding

By W. E. Moody and R. A. Green
SALES ENGINEER ABRASIVE ENGINEER
BAY STATE ABRASIVE PRODUCTS COMPANY

Part I

IN ORDER TO LIMIT this discussion to continuous mass production, it might be stated that finish grinding will be considered as the final grinding operation, normally done with a 46- to 120-grit wheel, and not the type of finishing that may be done by lapping, honing or even polishing. It may be interesting to note here that the controls imposed upon the latter three operations may be 100 percent dependent upon the control obtained in the finish grind. This is particularly true where honing, lapping and polishing remove only the so-called amorphous metal. See Fig. 1.

The problem of size control has numerous ramifications. Without it, mass production, with interchangeability of parts through quality control and inspection, would be useless. The tolerances to which industry works today are becoming tighter and tighter. The ability of the machines to meet and hold these tolerances has increased by leaps and bounds. Due to increased grinding and labor costs, it is fairly obvious that wherever possible, the man with the micrometer, who must start and stop his machine as he approaches the final tolerance, should be given the tools with which to work in order that he may not have to stop his machine and reload until the final tolerance has been reached. This sizing device should preferably be automatic and extremely sensitive.

Completely automatic size control will continually keep the infeed of the wheel in action until the final dimensional size is correct. With a completely automatic control the operator will only load and start the cycle, the control will then take over, or notify the machine when to take over; maintain this control through the heavy, medium and light infeed range, through the sparkout, if necessary, and then notify the machine to shut off, or shut it off. With a visual control gage, the operator watches the size gage and grinds in his own individual manner until the gage shows him the piece is done.

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March 1952

Gage-matic Type of Control for Internal Grinding

The most commonly used internal grinder employing the hopper feed, automatic chucking and automatic sizing cycle is the Gage-matic, which term is associated industry-wide with the type of machine using a plug gage (regardless of manufacturer) with one, two or three steps as a regulating device.

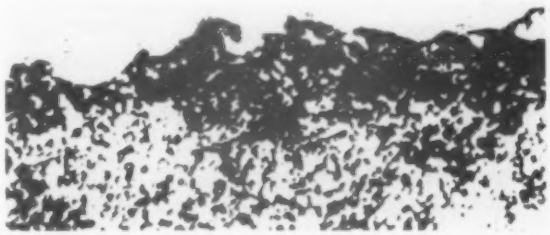
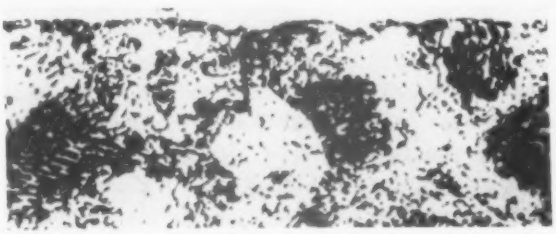


Fig. 1. (above) The profilometer on this surface is 80 microinches. The darkened areas on the surface represent amorphous smear.

Fig. 1A. (below) The profilometer reading on this surface is eight microinches. Most of the amorphous metal has been removed. Both views 750X, from "Superfinish," by A. M. Swigert.



The Gage-matic type of machine is universally applicable to that type of internal grinding where the hole to be ground runs completely through the work, as differentiated from the blind hole. See Fig. 2. Here is a case of absolute control vested in the sizing plug. Generally the plug has two steps. When the hole becomes large enough to allow the front end of the sizing plug to slip into the hole, the

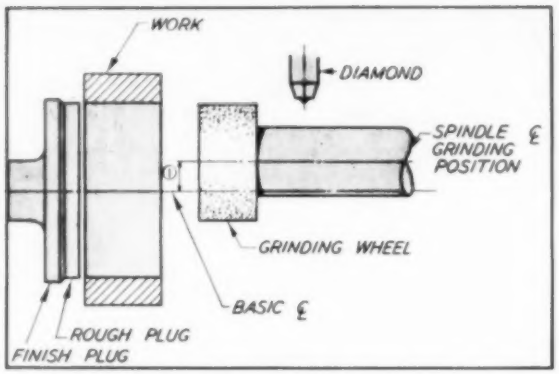


Fig. 2. Gage-matic type of internal grinder. Transmitter of size control impulses is the plug gage shown ready to slip into the work. The infeed (1) is constant and continues until the rough plug slides in.

roughing cycle is complete. An impulse is transmitted to the feed mechanism of the machine and one of three, or all three of the following steps can follow. First, the wheel may be dressed at this stage. Secondly, the infeed will pick up at a slower rate for finishing. Thirdly, the speed of oscillation may be slowed.

As can be seen, this is simply a refined GO and NO-GO gage control. By varying the number of steps on the gage, the machine can be made to perform exactly as desired, and as the economics of the situation demand.

Size-matic Type of Control for Internal Grinding

The second distinct type of size control used in internal grinding is the Size-matic. This type of machine, shown in Fig. 3, is particularly adaptable for the grinding of blind holes, or holes in which a plug cannot be placed without interrupting the cycle.

The maintenance of tolerance with the Size-matic will depend upon the fact that a given distance be maintained at all times between the wheel face and the finished tolerance of the work. Without wheel wear, glazing or loading, this problem would be relatively simple, since every cycle would be exactly like the preceding cycle and the chucking head would only have to feed in the same amount each time to maintain tolerance. Since grinding wheels always wear, and sometimes load or glaze, suitable means must be made to compensate for these characteristics. For instance, if experience shows that the wheel wear is two ten-thousandths inch per piece or less, by allowing the infeed to increase this amount each piece, tolerances will again be held. To overcome the other traits of glazing and loading, a diamond dresser can be positioned so that it may dress close to the finished tolerance base line, interrupting the roughing and finishing cycle. The Size-matic employs both of these stratagems. Both

TABLE I—COMPARISON OF NORMAL PRODUCTION CHARACTERISTICS OF SIZE-MATIC AND GAGE-MATIC TYPE INTERNAL GRINDERS

Characteristic	Size-Matic Type	Gage-Matic Type
Accuracy—Size	0.0003 in.	0.0002 in.
Quality—Surface	10 microin.	10 microin.
Type of Work	A wide variety of open or blind holes, tapered or straight. Crush forms possible.	Only those straight holes open at both ends into which a gage can be fitted from the chucking side of the work.
Remarks	For best performances, stock removal control is an aid. Might be superior in continuous mass production.	Gage-matic is probably more foolproof and possibly faster. More expensive. Probably most popular.

compensation and dressing are used, but unlike the Gage-matic, initial adjustments are necessary. Once the roughing and finishing cycle are set up, and the compensator adjusted for wheel wear, this machine will continually reproduce to the tolerance desired.

A certain method of size control quite widely in use in various industries such as the ball-bearing industry, consists of the application of a feeler gage

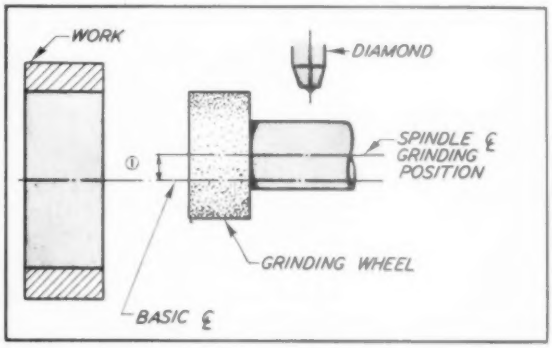


Fig. 3. Size control by timed operation is shown here. Total infeed (1) consists of total plunge to finished ID, plus wheel wear compensation. The change from rough to finish feeds is based on a time interval.

which rides in the surface to be ground. This method is particularly useful where the surface to be ground is of an unusual shape (such as a ball race) and not a plain surface. Naturally this operation can be an automatic operation with the feeler gage transmitting the impulses to the machine.

It is interesting to note here that on the Size-matic machine a crusher can be supplied in place of the diamond. The possibilities of crush form internal grinding for unusual shapes have not been fully exploited to date.

One of the major difficulties encountered with the Size-matic type grinding can arise when the stock removal on the inside diameter to be ground varies within a wide range. This can result in inconsistencies in the performance of the grinding wheel, such as low life, also loading, which will cause

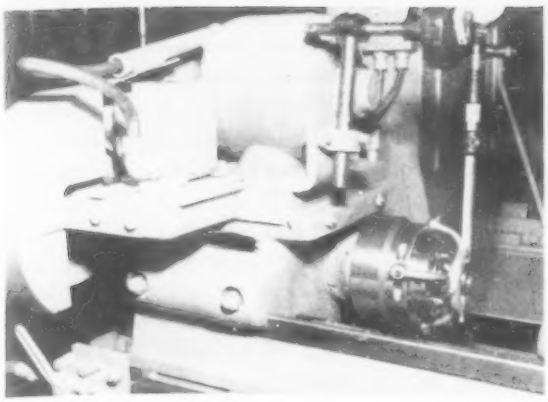


Fig. 4. A six-inch cylindrical grinder with a Foster visual gage indicating the hub of a pinion.

burning to appear on the work. This is a direct result of the pre-timed cycle. Since the machine will allow only a certain time for roughing, this means that, within certain limits, a given wheel will in that time remove, or is capable of removing, only a certain amount of stock consistently. The Gage-matic pays little or no attention to the amount of stock to be removed, but it roughs until a given diameter is reached, at which time it will automatically change its cycle. For the reasons stated above, the selection of a wheel for use on a Size-matic machine will require a little more study. It has been found that the grade range of the grinding wheels on the Size-matic machine is generally harder than for that used on the Gage-matic.

As far as costs are concerned, it would appear that the Gage-matic machine has a greater initial cost than the Size-matic due to the added equipment necessary for the Gage-matic process. A compensating factor is that the Gage-matic possibly is an easier machine to handle and set up on a job, and is possibly more foolproof. A comparison of the characteristics of both machines is shown in Table I.

Although at the present, gages ground internally have been produced perfect for roundness and straightness within tens of millions of an inch, and around 0 to 1 microinch finish, the processes producing this end result are not adaptable to mass production or gaging. Neither the relay system that conveys the start and stop impulses nor the feed mechanism itself reacts in a short enough period of time to produce tolerances in excess of one-ten-thousandth inch.

Size Control for Cylindrical Grinding

Much work has been done here and abroad on automatic sizing gages for cylindrical grinding. Practically the only application to date for these cylindrical grinding controls has been in plunge cut operations; that is, those operations where there is no wheel traverse. The gages used in this country include the Federal (Arnold) gage, the Foster gage and the Landis gage. The French have manufactured a gage named the Etamic air gage and the Germans used gages to quite a wide extent, especially during the World War II period.

Visual-Type Caliper Gage (See Figs. 4 and 5): Normally the bracket for this type of gage fits right on the wheel guard and can be raised out of the operator's way when not in use, or it can be swung down and placed on the work when necessary. The dial normally reads in tenths. The operator is the control; he observes the gage and runs the machine to the desired roughing, finishing and sparkout cycle. The caliper gage work contact shoes are usually carbide-tipped. Once the gage is zeroed in by the operator, his personal alertness is the basic limitation which controls the size of the workpiece.

Single-Contact Gages (See Fig. 6): The next step was a normal development, that of giving the gage a brain and allowing it to transmit the impulses at various stages of the grinding operation

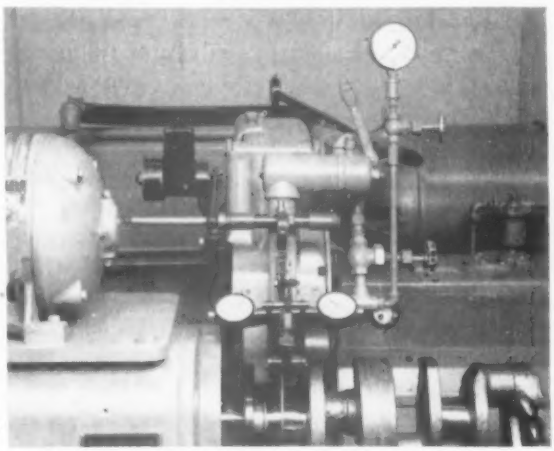


Fig. 5. A 10 x 36-in. cylindrical grinder using a Federal (Arnold) visual gage for indicating both diameter and width of a crank bearing.

to the machine control, thereby making the grinding cycle automatic. With the use of a single electrical contact in the gage, the infeed of the grinding wheel can be stopped, at which point a predetermined time for sparkout may be allowed, or the wheel slide may be detracted. Gages which perform this single function are called single-contact gages.

Double-Contact Gages. Since sparkout alone may not produce the extreme accuracy necessary for many operations, a double-contact gage was developed. The double-contact gage shown in Fig. 7 does everything the single-contact gage does, plus one additional operation. When the roughing or rapid infeed cycle is complete and the finishing size has been reached, the second contact is actuated and the machine feed slowed down. During this cycle, the wheel head is advanced very slowly, guaranteeing rounder work, and also more accurate sizing because of the slow infeed.

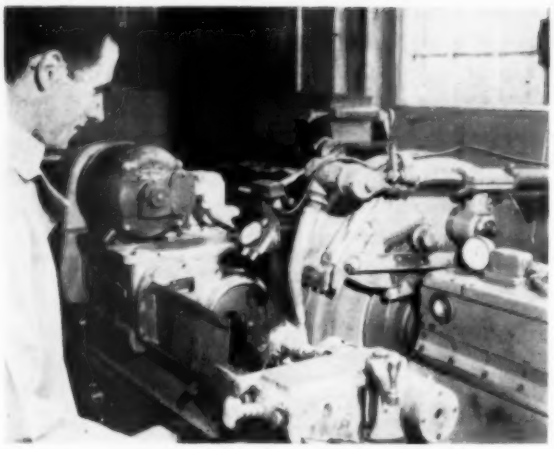


Fig. 6. A single-contact gage is positioned on the work on a six-inch cylindrical grinder.

A slow rate of infeed in the finish grind cycle is desirable. During the normal plunge cut grind with sparkout, two major factors can readily distort the final picture: (1) At a rapid rate of plunge, the wheel can "peel off" metal as you would pare a potato. When grinding to tenths with a gage (visual or single-contact) obloid diameters can result. (2) Due to a variety of conditions such as work heat from the plunge, frictional heat from the wheel under light loads (could result from glazing or loading), and wheel pressure itself, a distortion in the groundwork may be introduced. (Steel is an elastic substance.) The resultant condition could be undersized surfaces, barrelled surfaces, and concave centered surfaces.

With a slowed rate of infeed, and constant pressure, the finish cycle will produce rounder, more perfectly ground surfaces. More important, if this finish cycle is started at the same sizes on each diameter, control will be better.

One manufacturer makes a triple-contact gage which allows for a still slower infeed in the third cycle, and possibly still more accurate control.

Reasons for Automatic Gaging

Without a gage, an operator normally has to stop to gage or "mic" his work four to six times as he approaches his final tolerance. This can be eliminated on some operations.

An oddity connected with the cylindrical grinding operation (any grinding job for that matter) arises from the fact that as any grinder hand gains experience he becomes more and more adept at "working" his grinding wheel. It is a matter of pride with many operators to take any wheel and do all of their jobs with it. As a result, if an observer goes from plant to plant, he finds that on identical operations using identical machines, a wide variety of specifications of grinding wheels are being used, all giving good or acceptable results, but all subject to the individual operator's techniques. It is not too unusual to find four operators using identical machines, doing identical jobs side by side, but using four different wheel specifications. With the use of a gage, the following advantages can be obtained, which will allow standardization of method and wheel. First of all, a shorter grinding cycle can be obtained with a more uniform rate of infeed, both of which can be predicated upon the use of the best wheel for the job.

Also, there will be an elimination of scrap due to operator inattention or deficiences. This situation can become critical in the next few years. Quality control men should hope to find a controlled family curve narrowed down, through reduced rejects.

The following data, taken in Germany, illustrate some of the time savings. These illustrations show

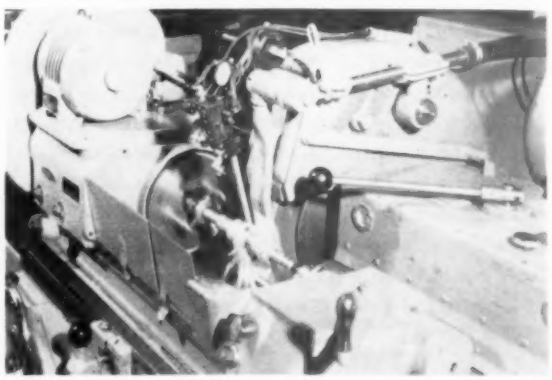


Fig. 7. This machine setup shows a standard mounting and positioning on work of a double-contact gage (Foster Electrosizer).

the type of savings made in one plant where a bolt approximately $\frac{5}{16}$ in. in diameter was being ground.

A typical floor-to-floor cycle is illustrated as follows: Work about 1 in. in diameter; tolerance (total indicator reading) 0.0001 in.; stock removal 0.024 in. on the diameter; single-contact gage; semi-automatic grinder. Handling time was 5 sec.; rapid infeed, 1.738 in., 2 sec.; grinding shoulder, 0.250 in., 1 sec.; body grind (rough), 0.001 in., 16 sec.; body grind (finish), 0.001 in., 6 sec.

The total infeed of 2 inches was accomplished in four steps. In this case, the last step only was under external gage control, but both final steps could have been. Floor-to-floor time is 30 seconds. Grinding cycle time is 25 seconds.

The type of control that can go hand in hand with these savings can be illustrated by the fact that on one operation where the permissible limit was 0.00012 in., 100 pieces were ground; 86 percent of the work was held within a limit of 0.00004 in.; 99 percent of the work was held within 0.000084 in. All pieces were held within the limit.

(Continued next month)

Mechanical Variable-Speed Drives

By Henry G. Keller
ASSISTANT CHIEF ENGINEER
PHILADELPHIA PLANT
LINK-BELT COMPANY

VARIABLE SPEED DRIVES are generally considered to embrace three basic types: electric (including electronic), hydraulic, and mechanical. The occasionally talked of decline of mechanical variable-speed drives in favor of the electric or hydraulic type has never occurred. It seems certain that the mechanical type of variable-speed drive fills a definite industrial need and that it will maintain its existing popularity.

Numerous reasons may be given for this statement. Low first cost is probably of first importance. Beyond this the fact must be considered that the electric and electronic variable-speed drives are prime movers, and are generally unsuited to provide a portion of a machine or process with variable speed beyond that provided by the common prime mover. Hence, for these latter applications, only the hydraulic and mechanical types are functionally competitive. From the economic viewpoint the mechanical type generally costs less.

The term variable speed, as used, is considered to cover drives which are capable of infinite speed adjustment within the limits of an overall ratio of variation and should not be confused with drives having two or more selective but fixed ratios. The latter units are considered to be multi-speed transmission units.

Types of Variable-Speed Drives

Variable-speed drives of the mechanical type make use of principles which have been known for a long time. The design, the materials, and the manufacture have materially improved but despite the countless designs that have been proposed, that have been used, or that are available today, all use one or more of the mechanical principles shown in Fig. 1.

In addition to these, various types of slip devices are used to obtain variable speeds, but they are not generally considered to be variable-speed transmissions.

All mechanical variable-speed transmissions are a compromise of design and operating principles; hence their maintenance costs generally exceed those of other mechanical drives of the fixed ratio type involving gears, chains, belts, etc. Also, variable-speed drives are less efficient than the fixed-ratio types. However, the maintenance costs and power losses are not generally excessive when considered in light of the design compromises.

Based on the number of manufacturers and on numbers of units sold, the general Class 4 (Fig. 1), having adjustable conical pulleys, is the most popular and is made by at least seven manufacturers in this country. When furnished as complete units, such designs are of the parallel-shaft type and one or more shafts carry a pair of adjustable conical pulleys. The common driving medium is a V belt drive which may be a standard section, single or multiple, wide single, or the built-up block type, as dictated by a particular design.

The P.I.V. Drive

The form of drive shown in Fig. 2 is known as the P.I.V. drive, which expanded means positive-infinitely-variable. It was introduced into America over twenty years ago and has an established place in industry, primarily due to its all-metal construction, the fact that it runs in oil and is splash lubricated, has high efficiency, and provides a positive form of drive.

In particular, this drive features a steel multi-linked chain having steel laminations which shuffle and reshuffle into driving contact with every meshing of the chain with the radial teeth of the conically shaped wheel faces.

To cover the entire field of mechanical variable-speed drives would be time consuming and comparisons would be difficult, since most manufacturers have different ratios of variation, horsepower capa-

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March, 1952.

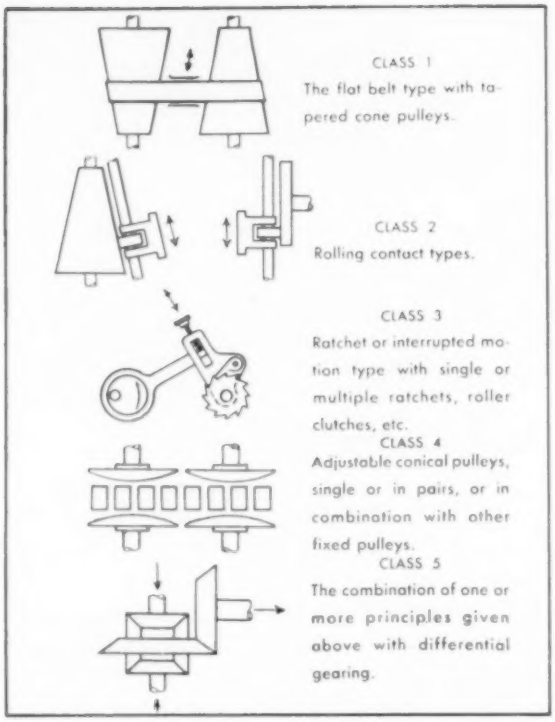


Fig. 1. Classes of mechanical variable-speed drives with infinite speed adjustments.

cities, and speeds which are not interchangeable. By confining the discussion to one manufacturer's current line of variable-speed transmission equipment, it is possible to make a clearer presentation as to the field of application that can be covered alone, or in combination with gearing of various kinds, and how the speed may be controlled. Generally speaking, other manufacturers can provide similar transmission designs.

Horsepower Versus Ratio of Speed Variation

Fig. 4 presents in composite form the horsepower capacities and ratios of variation which are obtainable by plain (simple variable speed) P.I.V. units or units in combination with various forms of transmission gearing. The outline drawings indicate the variable-speed transmission and auxiliary gearing that may be combined to cover the various requirements, from the viewpoint of variable-speed ratio only, exclusive of final speed requirements. Obviously additional gearing may be added to any of the outlines shown to provide desired final output speeds.

In Fig. 3 the area covered by *A* represents the horsepower capacities and ratios of variation provided by plain units, which are built in eight sizes ranging from ½- to 25-hp capacity with a maximum ratio of variation of 6 to 1. Most variable-speed application requirements fall within this area, since the greatest variable-speed field in terms of units sold is for capacities of five hp or less, and for ratios of variation of 4 to 1 and under.

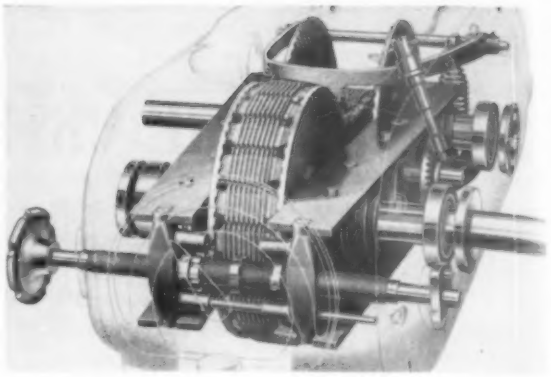


Fig. 2. The P.I.V. drive (Positively-Infinitely-Variable) is of all-metal construction.

This area covers the field for units that are readily custom assembled from stocked parts, which in most cases include motors, input and output gearing and a host of accessories. Interchangeability of parts is a fundamental consideration of the existing design.

The variable-speed range can readily be extended to the area *B*, (Fig. 3) by various means such as multi-speed input or output gearing, multi-speed prime movers where applicable, or tandem P.I.V. units arranged in series.

If the variable-speed requirements extend into the area covered by *C* (Fig. 3), then a P.I.V. unit controlling a power differential is the preferable equipment. For the higher horsepower capacities, some overlapping of methods exists since area *D* covers parts of areas *B*, *E* and *F*.

Area *D* outlines the field that is covered by two P.I.V. units in series with a power distributing differential on either the input or output, but not both, depending upon the particular application and its connecting drives. Obviously the control shafts should also be connected. For still higher horsepower it is necessary to reduce the ratio range of the combination as indicated and covered by area *E*. Finally, the area *F* is merely a multiple of *E*, provided by the addition of a multi-speed transmission unit as indicated.

Fig. 3 considered the horsepower capacity at the high speed as the criterion with an applied service factor of 1; other factors are given in Table I.

Most applications require constant torque capacity with horsepower varying directly in proportion to the speed; hence, maximum horsepower is required at the high speed. Torque characteristics of units may vary slightly; however, in general the rated torque capacity at minimum speed will be approximately double those at high speed.

There are some applications which are not covered by Fig. 3, such as those where high torque is required at the low speed, and low torque at the high speed. Such requirements might exist, for example, in a drive applied to winding up material at

TABLE I—SERVICE FACTORS FOR VARIABLE-SPEED DRIVES

Operational characteristic	Service Factor	
	Hours Operation Per Day	
	8 to 10	10 to 24
Infrequent starting	1.0	1.33
Frequent starting	1.33	1.67

a constant rate of surface speed under constant tension.

In the field of mechanical variable speed, Fig. 3 indicates the limitations to be chiefly horsepower capacity limitations, which may be reduced in the future by still larger (but as yet untried) designs. Finally, for comparison purposes, it should be pointed out that some competitive transmissions are capable of exceeding P.I.V. horsepower and ratio ranges by 100 percent.

Characteristics of Mechanical Variable-Speed Drives

Characteristics of mechanical variable-speed transmissions vary somewhat, dependent upon the design. All have some operational limitations such as being torque and speed conscious with limited accuracy of speed duplication.

Some ratio change occurs as a function of transmitted torque. For example, a P.I.V. with locked control, will vary approximately two percent of the ratio between zero and catalog rated load. This ratio change is always downward (tending to reduce the ratio) except in those cases where the transmission is an overhauling application, in which case the ratio would increase. The term ratio, as used above, refers to the speed of the output shaft divided by the speed of the input shaft.

Some ratio change occurs as a function of speed. For example, again with a locked control, under constant torque load, if the input speed is increased from a minimum speed of, say, 10 percent of normal speed to approximately normal running speed, some ratio change may occur (usually downward), roughly equivalent to less than 0.2 percent.

Accuracy, or ability to maintain and duplicate ratios from a previously recorded point, provides a further variable in amount of plus or minus of 0.25 percent for standard units and plus or minus 0.125 percent for preloaded units as applied to the ratio. The difference between standard and preloaded units is simply a spring loading which effectively preloads the control parts.

Some reduction can be made in the variables or their influence. For example, the variables due to torque are approximately proportional to the torque transmitted; by applying a service factor greater than one (1) the new torque variable value may be found by dividing the initial value by the service factor.

The speed variable cannot be reduced, although the effect may be manually or automatically corrected by extending the accelerating or decelerating time, which in turn allows more time for the observation or detection and correction.

Actually, it is possible to maintain much greater accuracy of ratio than the value stated when considered in terms of the product produced. For instance, if 30-in. lengths of paper can be cut consistently with a total tolerance variation of 1/32 in., then the P.I.V. unit must be accurate within 1/32 in. divided by 30 in., or within 0.1 percent. This is based on the assumption that all variables are produced by the P.I.V. unit, which assumption is fundamentally incorrect since other machine variables usually exist which produce a portion of the variance. It is possible to obtain infinite adjustment of ratio and maintain the ratio within less than 0.1 percent, subject only to the influence of torque and speed variables.

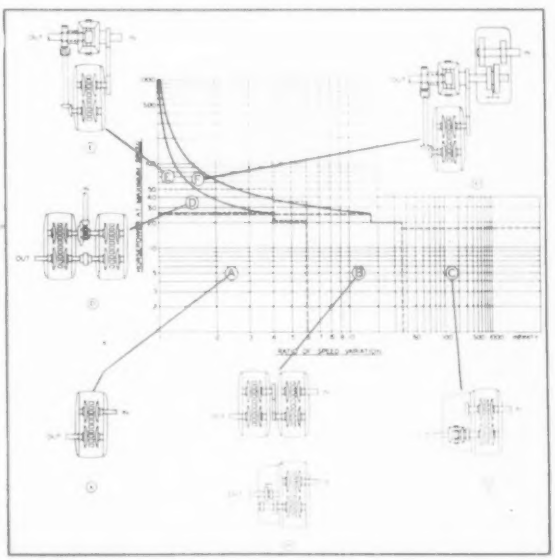


Fig. 3. Horsepower capacities and ratios of speed variation obtainable from P.I.V. units.

Controls for Variable-Speed Drives

The majority of variable-speed transmissions are manually controlled by a handwheel mounted on the standard control screw. Depending upon unit size and ratio, the control screw on the P.I.V. must be turned from 7 to 30 turns to cover the entire ratio range. When the ratio range must be covered by a comparatively small motion, a lever control is available which requires from 25 to 70 degrees (depending upon unit size and ratio) to cover the entire range. Cams are occasionally applied internally or externally to provide a specific speed curve.

For remote control, a fractional horsepower electric motor with built-in gear reduction is connected

Control Element →	Signal	Brain	Brawn	Control Characteristics
Control Function →	Detection	Analyzer and Amplifier	Changes the Ratio	
Class A	Continuous Floating	On—Off	Single Speed	Hunting
Class B	Continuous Floating	On—Off with Interrupter	Single Speed Pulsing	Hunting
Class C	Continuous Floating	Proportional	Variable Response Rate	Dampening
Class D	Usually Omitted	Usually Omitted	Usually Mechanically Driven	Positively Driven

Fig. 4. Control schemes for semi-automatic or full-automatic operation of variable-speed transmissions.

to the control screw, the ratio then being controlled by an electric push-button station from some remote or vantagé point.

When the application is such that extreme accuracy of speed adjustment is to be made manually, a vernier control is recommended, since this attachment provides a reduction ratio between the vernier control handwheel and the control screw. A second handwheel provides the means of making a major adjustment by turning directly the control screw.

For the semi-automatic or full automatic operation of variable-speed transmissions, a great variety of control schemes may be applied. Most control schemes consist of three elements. First there is a unit which is capable of transmitting a minute impulse to a receiver, which can then resolve the requirement, finally causing a relatively powerful actuator to change the ratio of the transmission. For more descriptive terms the initial unit can be called the signal, the second unit the brain, and the final unit the brawn. See Fig. 4. Signal, brain, brawn—this is the manner and order in which they function.

Signal devices are available that are actuated by speed, motion, temperature, voltage, pressure, vacuum, light, torque, tension, etc. Basically, the signal device either produces a small mechanical motion, or controls an electrical circuit. The transmission of the signal to the brain unit may be electrical, hydraulic or mechanical, or a combination. When the signal indicates a need for a ratio change, the brain unit resolves the need and causes the brawn unit to function. The brain and brawn units may be electrical, hydraulic or pneumatic, or a combination as determined by the signal device and the operating requirements under which the brawn unit must function. Hydraulically controlled units usually require a motor-driven hydraulic pump, whereas pneumatically controlled units operate on plant air pressure when available.

All controls are of the follower type; therefore, when something is out of balance (and bear in mind that a variable-speed unit has only one function and that is to control the mechanical ratio) a signal attempts to do something about the ratio variance. The signal needs to have only sufficient strength to register the unbalance at the brain unit. It takes only a split second to send a signal, a moment for the brain unit to receive and resolve the signal, and a little while to make the correction through the brawn unit. The time lag involved in many cases requires a suitable means to collect or pay out the portion of the material or process as necessary during the off-ratio period.

Quite often the collect or pay-out function is accomplished by a floating roll or arm; in other cases a loop of material between the various process steps provides the required time lag.

Semi-automatic or automatic controls are available in various designs involving electrical, hydraulic, pneumatic and mechanical equipment as shown in Fig. 4. Here again are limitations in the very nature of a follower control plus the time lag for correction. Again it is important to recognize that such a condition exists and to use designs that suit such a controlling means. While the time for response of control systems may vary considerably, it should be recognized that all controls follow the same pattern except possibly the slip clutch, which in effect is not a control, but just slip as governed by tension and/or torque.

As applied to variable-speed drives, with types A and B there is a floating signal element that has three bands, one for fast, one for slow, and a central dead band. Beyond the normal extreme limits of travel, safety bands may be required. The chief difference between A and B is that B includes an interrupter device which reduces the amount of correction versus time, since the interrupter produces a pulsing action to the brawn unit, and reduces the hunting effect.

Type C is a floating control which is capable of transmitting, receiving and correcting at a variable response rate as required. For instance, if the signal indicates a large difference in the required versus actual ratio, then the corrective brawn unit would function at maximum speed; if the signal indicated a small but measurable error, then the corrective brawn unit would function slowly. Actually there is in effect a dead band in type C controls, since the signal strength is proportional to the unbalance, and until the unbalance has sufficient signal strength to cause the brain unit to operate the brawn unit, the unbalance will exist. If the signal control over the brain unit is supersensitive, then the result is excessive hunting.

Type D usually is a semi-automatic or full auto-automatic control that establishes a speed versus time relationship through the medium of mechanically driven gearing or cams, commonly called a program control.

Job-Tests Aid Production Personnel

By Joseph E. King
EXECUTIVE DIRECTOR
INDUSTRIAL PSYCHOLOGY, INC.

Part I

THERE IS ALWAYS an employee handling the tool. Unfortunately, many companies concentrate only on the tool, letting the man problem take care of itself. While most companies will study the purchase of a $5,000 machine from all angles, many will hire factory employees merely by an interview over the counter. Yet the average semi-skilled worker represents an investment in one year of $2,500; his turnover and replacement will cost the company about $555. A tool engineer is an investment of $7,000, and a replacement loss of over $1,500. While there are only a few companies which still buy tools and equipment with the naked eye, there are still many companies which hire factory personnel that way. They rely on impressions made during an interview, on how the applicant looks, whether he speaks familiarly of machinery; little weight is given to the applicant's actual aptitudes for factory work.

During the past five years, research studies have been made on some 230,000 employees in about 500 companies in business and industry, evaluating the work and the aptitudes of these employees, and how these fit together. Of that total number of 230,000 employees, some 100,000 were non-clerical production personnel in plants and factories.

One aspect of this study dealt with proper placement of personnel through aptitude testing. One aim was to find out whether employees were being properly selected and properly placed, and what psychological factors were responsible for the job success or failure of these men and women. A second objective was concerned with improving those instruments of selection for the benefit of those companies which cooperated in the studies and for other companies anxious to improve their selection methods.

As far as production personnel is concerned, five significant conclusions result from these studies:

(1) When the many types of plant jobs are studied in terms of the aptitudes needed to learn and perform these jobs, it was found that the hundreds of different jobs could be resolved into six basic mechanical categories. These six categories are unskilled worker, semi-skiller worker, inspector, factory machine operator, vehicle operator, and skilled worker. Most factory jobs, in all types of industries, may be grouped under these six headings.

(2) Aptitudes of coordination, tool comprehension, perception of object details, and visualization in two and three dimensions are highly important in mechanical performance. Employees lacking these aptitudes are very poor job risks. Moreover, it is impossible to tell whether prospective employees have these aptitudes merely by interviewing them, or even studying their job histories.

(3) Many factory workers are overqualified. They have too much aptitude for the detail type of job they are doing, and the challenge they need is lacking in their jobs. In view of the fact that factory jobs are becoming more and more subdivided into simpler tasks, there is a good deal of simple, routine and repetitive work in every plant, and thus a good deal of opportunity for the worker to become bored. The overqualified semi-skilled worker is an asset only if his overqualification is known, and he is earmarked for advancement or special assignment. On the other hand, where the employee is overqualified, his tenure with the company ranges from two days to three months.

(4) The aptitudes required for the six basic factory job categories differ sufficiently so that applicants cannot be placed indiscriminately in a job area where there happens to be a vacancy. To insure maximum personnel efficiency in a factory, present employees must be transferred, promoted, and upgraded only with foreknowledge of their aptitudes and abilities.

(5) Psychological job tests, simple to administer and interpret, are now available for all factory jobs, thereby easing the selection process for all personnel directors.

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March, 1952.

Testing Is a Complex Subject

The problem of testing plant personnel is a thorny one, and can be discussed in one of several ways. The simplest method is to pull together some anecdotes, an amusing story here and there, and wind up with an encouraging word about the simplicity of it all. Unfortunately, that is of no help to the factory manager or personnel director who has the

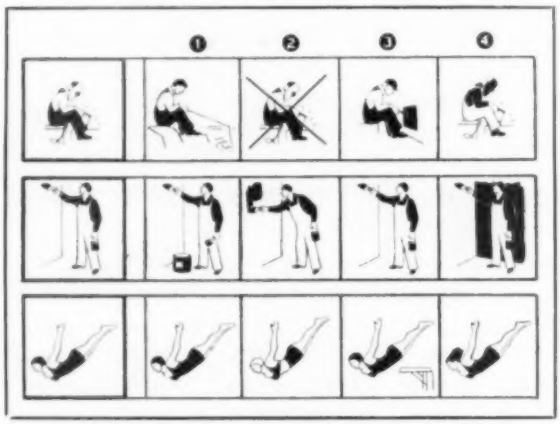


Fig. 1. In this precision test, the subject is told to look at the picture at the left and mark the one of the other four which is exactly the same. This is a test of perception of details, an attitude which is very valuable mechanical ability.

responsibility of selecting factory workers. He wants to know whether tests should be used at all, what tests to use, and how to interpret the results.

Basic Job Areas. To begin with, there are some 29,000 different types of occupations in the United States; there are over 10,000 different factory job titles alone. To find different suitable psychological tests for every job would be a monumental task, were it not for one discovery made early in this project. Studying all of these occupations from the point of view of aptitudes required to learn and perform the jobs well, it became apparent after much cross-checking that the 29,000 different jobs could be broken down into 24 basic job areas. The many jobs in each job area resembled one another because the same general group of aptitudes was involved.

For example, what have the following jobs in common: grader, scaler, examiner, passer, selector, sorter? It was found that they all require three abilities: aptitude to comprehend tool information, perception of object details, and ability to visualize part-whole relationships. A high score in coordination or motor ability, for example, would be no indication either way as to whether the applicant could fit into one of these jobs, although good motor aptitude is a prerequisite for most factory jobs other than the inspector job area. Similarly a high or low score in judgment would be as irrelevant as an applicant's hair color. By the same token, the assembly worker requires four aptitudes for job success: tool comprehension, object perception, visualization ability, and coordination aptitude. A well developed physique has no relation to ability to do this job. Figures 1 and 2 are relatively simple tests of two different aptitudes; innumerable other tests are necessary over the full range of industrial tests.

Six Job Families. By uncovering the basic similarity among the different 29,000 jobs, it was possible to set up the 24 basic job areas into six job families. The jobs in each job area require similar aptitudes and from that point of view can be lumped together. These 24 job areas group themselves into six job families, as follows:

Plant, Factory or Mechanical Family: Un-

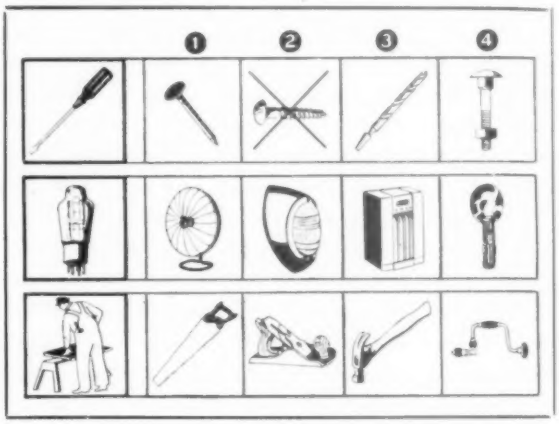


Fig. 2. This is a tools test. The subject is told to select the picture from the four on the right that belongs with the one on the left. This test measures the comprehension or understanding the employee has about common tools, machines and equipment found in all types of plants. It also indicates the degree of interest in the mechanical field.

skilled worker, semi-skilled worker, inspector, factory machine operator, vehicle operator, skilled worker.

Clerical or Office Family: Junior clerk, numbers clerk, office machine operator, senior clerk, contact clerk, secretary.

Sales Family: Sales clerk, salesman, sales engineer.

Technical Family: Scientist, engineer, office technical, writer, designer, instructor.

Supervisory or Administrative Family: Office supervisor, factory supervisor, sales supervisor.

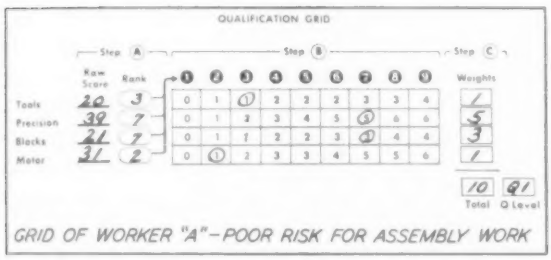
Job-Aptitudes: After determining into what categories the factory jobs fell, the next step was to analyze each plant job to see what specific aptitudes were important there. After all, there is no point in testing an applicant on the aptitude to perceive details in words and numbers (primarily a clerical aptitude), if the job didn't require such ability. Table I gives the eight independent aptitudes established by long research, a description of each aptitude, and its relation to factory jobs.

Factory jobs are concentrated mainly in the six job areas in the mechanical job family. Table II shows the aptitudes involved in these areas. More than one star indicates that the aptitude is highly important in that job area and must be weighted in scoring. Note the different patterns of aptitudes and weights involved for different jobs, and thus the difficulty of hiring and correctly placing personnel becomes apparent.

Unless a proper battery of psychological aptitude tests is used, with correct weights for the most important aptitudes, it is evident that testing becomes a complicated procedure. On the other hand, with a correct battery and correct weights, testing becomes a simple matter.

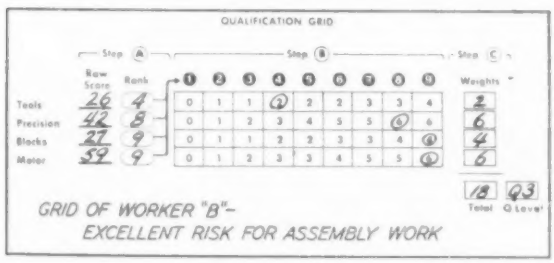
How Tests Work in Factories

The first phase of testing applies to new applicants. James Smith applies for a job as an assembly worker. The assembly worker job falls in the semi-skilled worker area. Thus, Mr. Smith is given the four tests which make up the semi-skilled job tests battery. His tests are scored in a simple manner which can be handled by any secretary, and the scores placed on the grid which accompanies the semi-skilled job tests battery. The grid, because it



GRID OF WORKER "A"—POOR RISK FOR ASSEMBLY WORK

Fig. 3 (above) and Fig. 4 (below). On these two grids are shown the scores achieved by two semi-skilled workers when given a battery of tests. The two men were tested for assembly jobs. The results indicate (see text) that worker A is an employment risk, while worker B is an excellent one.



GRID OF WORKER "B"—
EXCELLENT RISK FOR ASSEMBLY WORK

is based on the performances of many employees, gives a basis of comparison between the standard score of thousands of employees and the score made by the particular applicant taking the test. This grid automatically shows the applicant's level of qualification or the risk involved in hiring him. Figs. 3 and 4 show two grids and case studies of semi-skilled worker applicants.

TABLE I—THE APTITUDE IN RELATION TO FACTORY JOBS

Aptitude and Description	Importance in Factory Jobs
COMPREHENSION—Aptitude to understand ideas, words, pictures, other types of information in business and industrial fields. Tests of comprehension are available in the office, sales, mechanical and technical fields.	Tool or mechanical comprehension of particular importance in factories. Indicates both an ability to understand and learn the work, and interest in the mechanical area.
REASONING — Aptitude to attack and solve difficult problems, to think logically, to foresee and plan.	Important in higher level factory jobs, such as engineer, job master, etc. Too much reasoning at low level jobs is index of overqualification.
SYSTEMS — Aptitude to work with systems, files, codes, symbols, other standard procedures.	Certain factory jobs require this aptitude, where, for example, measurement or computation is involved. Not a mechanical aptitude in general.
PERCEPTION—Aptitude to scan and locate details quickly, to recognize likenesses and differences rapidly.	Perception may be of words, numbers, or objects. Object perception is an important mechanical aptitude, needed particularly in inspection work.
FLUENCY—Aptitude to use words with ease —to write and talk without blocking or searching for the right word.	No relation to factory jobs. This is a contact or sales aptitude.
MEMORY — Aptitude to recognize and recall associations, such as names, numbers, faces, events, etc.	No relation to factory jobs. Like fluency, this is a contact or sales aptitude.
SPACE RELATIONS —Aptitude to visualize sizes, shapes, and spatial relations of objects —in two and three dimensions.	This is the basic mechanical aptitude. Every factory worker should score at the average or preferably above the average of the general employed population on this aptitude.
COORDINATION — Aptitude for fine and gross muscle control; coordination of eye and hand.	A second aptitude of importance in plant work, where manipulation of objects or materials is required.

TABLE II—APTITUDES NEEDED IN JOB AREAS OF THE MECHANICAL JOB FAMILY

Aptitude	Unskilled Worker	Semi-Skilled Worker	Inspector	Factory Machine Operator	Vehicle Operator	Skilled Worker
Tool comprehension				•	•	••
Office comprehension						•
Systems						•
Perception (Object)	•	••	••	•	••	•
Space relations		•	•••	•	•	••
Coordination	••	••		•••	•••	•

Case Study of Assembly Worker "A" (Fig. 3). Man A took the semi-skilled worker job-test battery for the assembly job. After he completed the tests, the first step was to score his test forms. This is done simply by a scoring stencil which is placed next to his answers, and the correct answers checked off.

A raw score is obtained as seen in Step A in Fig. 3, the raw score being the number of correct answers he gave to the 40 or so test problems he worked. Man A made a raw score of 20 on the tools test.

After all the raw scores are obtained, another table is used to translate the raw scores to a rank. The rank is on a nine-point scale, and translates the man's raw scores into a score which can be interpreted in relation to the general employed population. Ranks of 1, 2 and 3 are low, and an applicant who scores there is in the bottom 25 percent of employed workers. When an aptitude is highly required by a certain job, it is essential that the applicant be in the 7, 8 or 9 bracket.

From his test scores, it is seen that Man A is below the general population average in tools (rank of 3), and in motor (rank of 2.) These are important aptitudes for assembly work, and indicate major weaknesses.

Note, however, that Man A makes 7 scores in precision and blocks. The precision test measures the ability to perceive details in objects. Thus, while Man A knows little about the mechanical area and is weak in coordination, he has good visual or inspection aptitudes.

When his four aptitudes are weighted (note the black numbers inside the grid under Step B), he receives a weight of only 1 on tools and memory, a weight of 3 on blocks, and a weight of 5 in precision. Summing these weights in Step C, he obtains a weighted score of 10. This places him at the Q1 level and indicates he is 'minimum qualified,' that is, an employment risk to be hired only in a tight labor market.

Since Man A had strong points in the inspection aptitudes, he was given the inspector job test battery. On these tests, he qualified at the Q2 level, which means 'better-than-average' risk for employment.

Case Study of Assembly Worker "B" (Fig. 4). Man B, as contrasted to Man A, is an excellent risk for an assembly job. When Man B's four aptitudes are weighted on the grid (in Step B Fig. 4), he receives weights of 2, 6, 4 and 6, and a total weighted score of 18. The highest possible total is 20. His score indicates a Q3 or 'well-qualified,' and Man B should work out quite successfully as a semi-skilled worker.

Looking at his individual test scores, it is seen that he has very good aptitude on the motor (rank of 9), blocks (rank of 9), and precision (rank of 8) tests. In fact, he is in the upper 25 percent of the population in all of these abilities. He will do excellently on tasks involving coordination of the eye and hand, visualization of objects, and perception of object details.

His average tools score (rank of 4) is sufficient for assembly work, but does indicate a weakness. Man B has much less ability to comprehend, and actually less interest in mechanical work, than he has other mechanical aptitudes. Thus his job assignment should place as little stress as possible on tools, machines and equipment. In light of this tools score, he would be limited in his ability to advance to the skilled worker job area.

Pretesting of applicants has a number of advantages. Take as an example the female factory applicant who is just out of school or a housewife who has never worked before. One case of interest is that of the high-school graduate who applied at a local factory for a job. She was given the job tests for inspector. She did very well on all the visualization tests, but was weak on tools. She was placed on an inspection job which involved use of no machines or tools, but stressed rapid inspection of various types of materials. Without the use of aptitude tests, the employment interviewer would have had little basis for evaluating this girl's job risk.

Another instance where tests can aid the employment interviewer is in checking employees with a known work history. A man who had been working as a lathe operator applied for a factory job. The immediate inclination was to put him on a lathe job, but since the company used the job tests as part of the regular hiring procedure, he was given the job tests for factory machine operator. His coordination or motor dexterity aptitude showed up very low, but he was very strong in mechanical and tool comprehension, and also in general intelligence. In checking with his past employers, the interviewer found that this man had been only an average performer on a lathe. Following this lead, he placed the man in an apprenticeship training program for maintenance and setup men. The man went through training with flying colors, and in a factory with 20 other maintenance men, this man, in five months, has the best efficiency rating. With-

(Continued Next Month)

Straight Drilling of Deep Holes

By Andrew E. Rylander

WHILE DRILLING IS one of the more common operations in metal processing, deep hole drilling is a special field and demands a knowledge of the technique on the part of the operator since the procedures differ from those used when drilling comparatively shallow holes. Confining the discussion here to what may be termed medium-deep drilling, that is, on blind holes up to about 12 in. in depth and deep in proportion to the diameter of the drill, the recommendations presented may serve as a basis for study when considering drilling problems involving new and untried applications.

The steps involved, and the precautions necessary to insure accuracy, are largely similar to those employed for gun drilling, but there is nevertheless enough difference in procedures so that the two should be treated separately.

Fundamentals of Precision Drilling

As a first step toward producing a straight hole, the drill must be properly ground. The web must be exactly central, and lip angles and lip relief angles identical. The required accuracy can be achieved only through sharpening with a drill grinding attachment, or on a grinder especially designed for drill sharpening. Few if any craftsmen, no matter how highly skilled, can consistently hand-grind drills so that they will cut to exact size. If the sharpening is wrong, the hole will also be wrong.

Next, the drill must be selected for the material to be drilled. Some materials require a reduced rake, others a hooked rake. Some require a high twist, some a low twist or, in technical language, high or low helices. In any event, twist must be sufficient to clear the chips. Some materials must be drilled dry, others with coolant or lubricant. In deep hole drilling especially, coolant should be applied under pressure wherever possible, using oil drills or drills especially designed for pressure cooling.

The drill must start dead true, either in a previously centered or spotted hole or, according to accepted practice, through a drill bushing. If a bushing is used, it is essential that it fit closely around the drill. Any appreciable looseness will cause the drill to "walk," thus starting the drill off center and resulting in curvature of the hole.

Whether starting in a spotted hole or through a bushing, the start must be in absolute alignment with the drill press spindle. Any misalignment, no matter how slight, will cause a bending of the drill, in turn resulting in curvature. The deeper the hole is, the more pronounced will be the deviation from a straight line.

Feeds and Speeds

Feed, whether power or manual, should be fast enough to produce an adequate chip, but not so fast as to cause bending or springing of the drill. Any bending will immediately start a deviation from a straight line. Springing is of lesser moment where large drills are used, but is of particular concern when using small drills. In any event, long drills must be used for deep hole drilling; consequently, there will be more tendency to spring than when drilling shallow holes.

For deep hole drilling operations involving conventional types of drills, the table of advisable reductions in speeds and feeds of drills to be applied as the depth of the hole increases is shown in Table I. The performance of the drill should be observed constantly, since the character of the chips is an excellent indication of the manner in which the drill is functioning.

The nature of the material being drilled will dictate whether or not coolant is to be used. When used, the flow must be copious if it is to do any good. And since chip exit along the flutes will tend to prevent coolant from getting to the point of the drill, deep hole drilling calls for use of oil drills, as stated above. Unfortunately, these drills

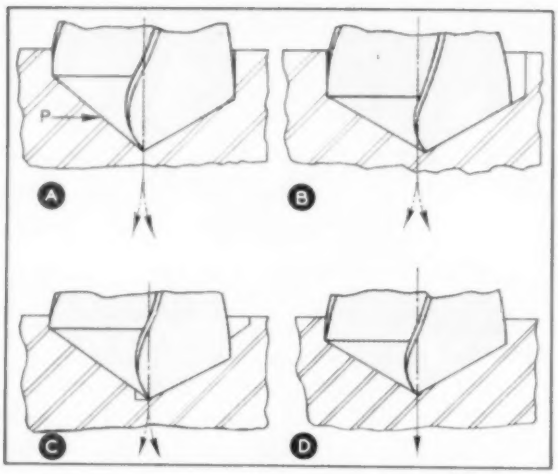


Fig. 1 shows the effects of improper and proper grinding. At A, the web is central but the lip angles are different. At B, the lip angles are alike but the web is off center; and at C, the lip angles vary and the web is off center. Drills so ground will cut oversize, with probability of a curving hole. The drill shown at D is properly ground, with lip angles alike and the web central; so ground, the drilled hole should be straight and of correct size.

are not available in the small sizes.

The machine should be rugged enough for the work so as to absorb vibration. In particular, the spindle must run true without appreciable play in its bearings. The chuck must also run true. Here, however, the paramount consideration is that the table be exactly 90 deg in relation to the spindle axis. Out-of-square will not necessarily cause curvature, but will cause the drill to deviate from its intended course.

The work-holding fixture should be rigid, with clamping arranged to secure the workpiece solidly against stops or locating points. The drill-line axis must be exactly 90 deg in relation to the fixture feet. Out-of-squareness of both fixture and drill press table will compound errors. Finally, bushing center lines must be in exact alignment with the drill press spindle. If only one hole is to be drilled, the fixture may be clamped to the table; if several holes are to be drilled, the fixture should be brought to a positive stop for each hole, and there locked in place.

Fig. 1 shows the effects of improper and proper drill sharpening. A drill point having the web or chisel point central but lip angles different is shown at *A*. The sharper angle will exert a wedging action, tending to crowd the drill in the opposite direction. A drill with identical lip or point angles, but with the web off center is shown at *B*. At *C* is shown a drill with different lip angles and with the web off center. A drill ground as at *A* will cut to size at the start, but may tend to enlarge the hole; drills ground as at *B* and *C* will cut large. All three will tend to deviate from a straight line as indicated by the arrows. The drill shown at *D* is properly ground, with the web central and the lip and lip relief angles equal. All other considerations for straight drilling have been met, it will drill a straight hole.

Sketch *D*, Fig. 1, is elaborated on in Fig. 2, *A*, *B*, and *C*. Sketch *A* shows equal lip or point angles, indicated by *P*; sketch *B* shows the lip relief angle, which must also be equal on both sides of the web; in sketch *D* the web is central with the drill body. While correct grinding is absolutely essential in deep hole drilling, it holds for all precision drilling.

Fig. 3 shows, at left, a section through an oil drill; at center, a section through an oil groove drill; and at right a modification of the oil drill.

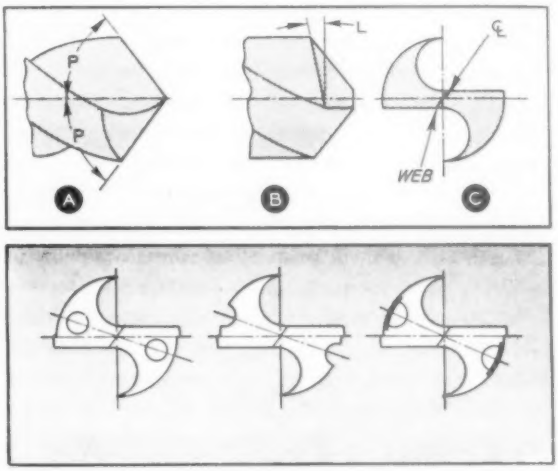


Fig. 2, above, shows the proper grinding of a drill. At A, lip or point angles P are identical; the sketch at B indicates that lip relief angles L must be alike; sketch C shows that the web must be central in relation to the drill diameter.

Fig. 3, below, shows at left an oil drill; at center, an oil groove drill; and at the right, an oil drill having a milled duct capped with brazed-on metal strip.

Here the duct is milled along the flute and capped with a brazed-on strip of metal. The latter type has the advantage of providing a larger duct area for coolant flow.

Effects of Misalignment

The relative effects of alignment and misalignment are shown in Fig. 4. While the misalignment indicated at *B* is somewhat exaggerated, the results would be the same if the misalignment amounted to only one or two thousandths of an inch. Starting out of line, the hole would deviate from a straight line and result in curvature. The same condition would result from too much play between the drill and the bushing, or from excessive pressure which would tend to spring the drill.

TABLE 1—REDUCTION IN DRILL FEED AND SPEED FOR SUCCESSIVE INCREASES IN HOLE DEPTH*

Depth of hole, in multiples of drill diameter	Reeduction of speed, percent	Reduction of feed, percent
3	10	10
4	20	10
5	30	20
6	35-40	20
7	35-40	20
8	35-40	20

*From the *Tool Engineers Handbook*.

Rotary Bushings for Precision

Precise though the standard plain drill bushings may be, they are nevertheless far short of the ultimate where precision deep hole drilling is concerned. They must have sufficient allowance for a running fit in the bushings at high spindle speeds, and for expansion of the drill due to heat. This clearance is enough to cause "walk" of the drill on starting, which will crowd it against one side of the bushing. In turn, this will lead to curvature. Besides, the rubbing of the drill against the bushing wall and passage of chips through the drill flutes will cause wear on both drill and bushing, a condition that will be aggravated with the passage of time.

For this reason, rotary bushings are recommended for deep hole drilling, that is, where they can be used to advantage. See Fig. 5. They have

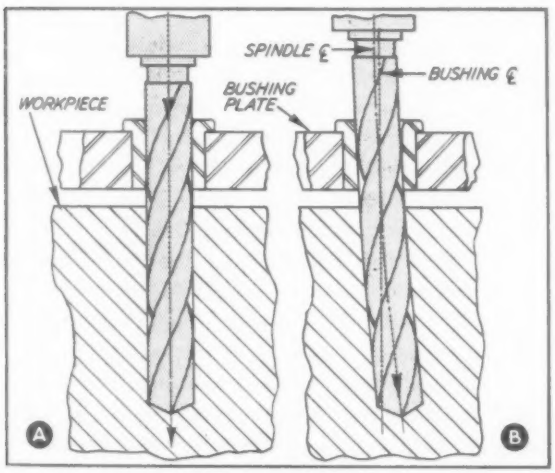


Fig. 4 shows at A how alignment of spindle, drill and drill bushing tends to produce a straight hole. The somewhat exaggerated sketch at B shows how misalignment tends to bend the drill during down-feed, resulting in progressive curvature as the hole deepens. Bending may also occur from a too heavy feed; it may also result in drill breakage.

the disadvantage of large size as compared to standard bushings and therefore cannot be closely clustered. For the drilling of a single hole, however, they serve their purpose admirably, and closely adjacent holes may be drilled by mounting them in an indexing bushing plate, as suggested by Fig. 6.

Here, because rotary bushings have been recommended for precision drilling and boring applications in previous articles, the writer will have to risk a suspicion of bias or single-track-mindedness. However, rotary bushings alone provide the ultimate in drilling accuracy. They permit a plug fit

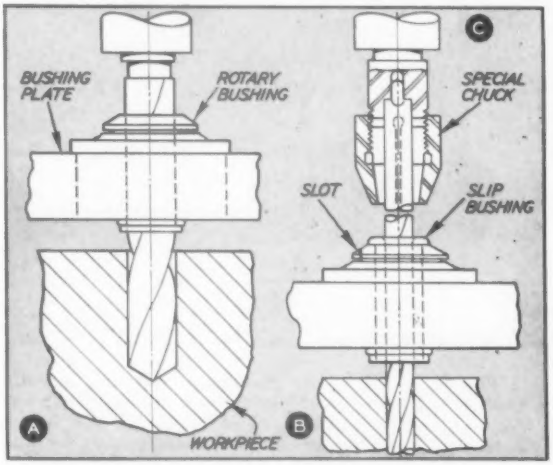


Fig. 5, shows at A and B applications of rotary bushings. Because of their close fit around the drill, these bushings prevent "walk" and the wear that would ordinarily result from the use of plain bushings. Sketch B shows how the rotor or a rotary bushing may be slotted for holding while inserting and removing slip bushings. Sketch C shows a special chuck, such as may be used to hold small diameter straight-shank drills.

on the drill, without any clearance beyond that needed to push the drill through the bushing. Because the bushing rotates with the drill, there is an irreducible minimum of wear.

When it is desired to first drill and then ream a hole, rotary bushings may be fitted with slip bushings, as indicated at the right in Fig. 6. Because the rotary bushing will tend to turn while inserting and removing the slip bushing, this difficulty can be obviated by the simple expedient of grinding a slot in the rotor and holding it with a spanner while exchanging slip bushings. In any event, the use of slip bushings will adapt the rotaries to the smallest drills that are practical for use in deep hole drilling.

As for the type of drills to be used for deep hole drilling, a taper shank is preferred over the straight shank within the sizes in which they are available as standard. The reason is that taper shank drills may be inserted directly into the spindle taper and are not subject to runout which may occur through use of any except ultra-precision drill chucks. While the latter are naturally preferred over any improvisation, small straight-shank drills may be chucked in a holder such as suggested at *C* in Fig. 5.

The chuck shown has only two parts, a taper-shank body and a closing nut. The chuck itself is bored to the diameter of the drill to be used, slotted to provide clamping of the drill when the nut is

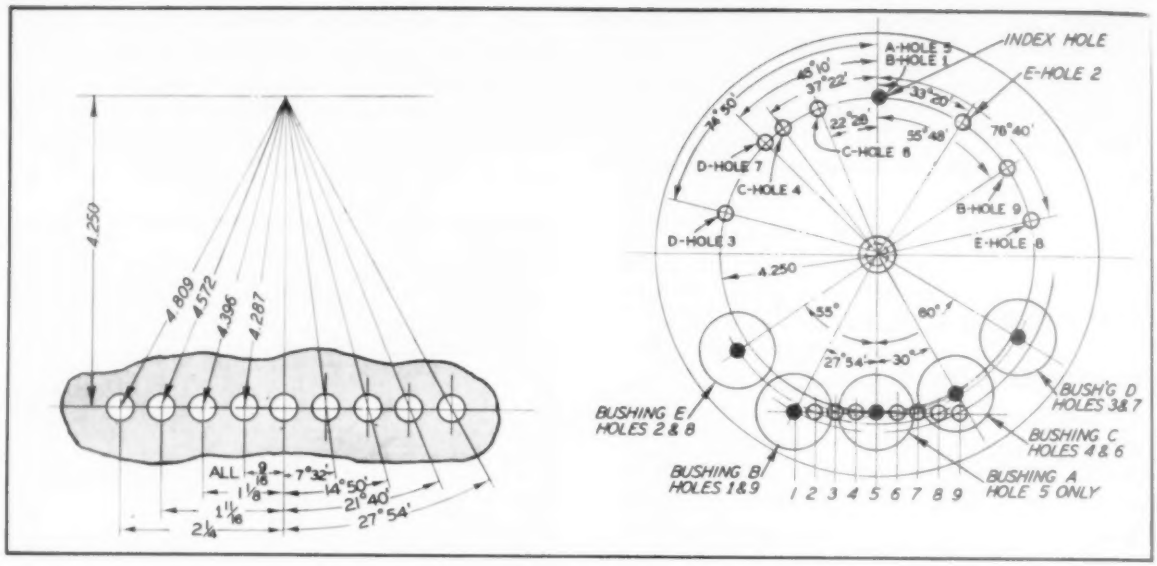


Fig. 6. At the left, encircled, are nine equally spaced holes, suggestive of close-center drilling in a typical workpiece. At the right is an indexing bushing plate such as may be used to adapt rotary bushings for close-center drilling. The center of the bushing plate is 4.25 in. from the center line of the holes to be drilled, and figures for calculation may be had from the sketch at right. Procedures for design are contained in the text.

drawn up on the taper nose, and spring-tempered. It has the disadvantage that it will take only one size of drill, a matter of no particular concern if only one size drill is to be used.

Indexing Bushing Plate

Mention was made above of mounting rotary bushings on an indexing bushing plate to adapt them to close-center drilling. The encircled nine holes, Fig. 6, suggest such drilling. As the smallest rotary bushing is two in. maximum OD, it is obvious that the diameter determines the closest center-to-center spacing. Since, however, the distance from the center hole to either of the end holes is $2\frac{1}{4}$ in., it becomes apparent that two bushings can be disposed in this distance, with room to spare.

Holes 1 and 9 are equidistant from the center line, or hole No. 5; so are holes 2 and 8; 3 and 7; and 4 and 6. Therefore, one bushing will serve for each of these four groups, or five bushings in all for the nine holes since the center hole, No. 5, will require a separate bushing. Bushing *A*, then, serves the center hole only; bushing *B*, holes 1 and 9; bushing *C*, holes 2 and 8; bushing *D*, holes 3 and 7; and bushing *E*, holes 4 and 5.

All of these holes are on a straight line 4.25 in. from the center line of the bushing plate. Hole No. 5, and each group of two, are on different radii from the bushing plate center, as indicated by the figures in the sketch at left. From these radii, and the cumulative hole spacing, plus the 4.25 in. dimension, may be calculated the angles of all holes in relation to the vertical center line.

The index plate has seven accurately spaced holes, with the index pinhole in the base plate shown in black, at top of the right-hand sketch. With the index plate positioned as shown, holes 1 and 5 may be drilled with bushings *A* and *B*. Rotating the plate counter-clockwise until hole *B* aligns with the index plate permits drilling of hole 9 with bushing *B*. This completes drilling of holes 1, 5 and 9.

Now, aligning index hole *C*-6 with the master index hole moves bushing *C* over hole 6; that drilled, a further clockwise index aligns hole *C*-4, moving bushing *C* over hole No. 4. Similarly, indexing to *D*-7 and *D*-3 moves bushing *D* over the corresponding holes to be drilled, after which holes *E*-2 and *E*-8 will align bushing *E* with drilled holes 2 and 8.

Fig. 6 is presented here mainly for the purpose of showing the procedures for making an index bushing plate for close straight-line hole spacing. The principle of design will serve for even closer straight-line hole spacing with standard bushings; for such purposes, it makes a handy gadget.

The drawing has no particular application but merely suggests a principle. Furthermore, angular spacings are only approximately correct, being taken to the nearest minute of a degree, probably close enough for the majority of drilling work. For the ultimate in accuracy, however, hole spacings should be given in decimal dimensions, not in degrees or fractions of degrees.

Summing up, it may be stated that if precision is to be achieved in deep hole drilling, accuracy must start with the drill itself. If the drill is improperly sharpened, or if it runs out, it will cancel all other factors, no matter how carefully they may have been considered. For that matter, all of the factors are important in themselves and in relation to the whole.

Precision Hole Locating Methods

By Frederick C. Victory
CHIEF ENGINEER
MOORE SPECIAL TOOL COMPANY, INC.

Part I

A FEW YEARS AGO layout, buttoning and transfer were the accepted practices for precisely locating holes. The necessity for higher accuracy in the meantime has made these methods makeshift and their results less accurate than today's standards.

To fill the widening gap between the increasing demand for accuracy of location on one hand, and the limitations of existing methods on the other, a new system developed. The word system is used since it included a new dimensioning technique, a new and highly specialized machine type, along with a new concept of operation.

Location of points by rectangular coordinates in design dimensioning, in machining and during inspection formed the foundation of this new system. See Fig. 1. The measuring or positioning means in the newly developed jig borer became the physical embodiment of the coordinate principle.

Some years after the development of the jig borer for use with machinable materials, the pressing need for a machine of similar function in locating holes in hardened steel and carbide fostered the development of the jig grinder. Together, the two types represent an engineered solution to the hole location problem.

It would be over-simplification to describe these machines as being capable of accurately positioning any required point on the workpiece in line with the spindle axis. In order to fulfill its function, the geometry of the machine, i.e., its squareness of rectilinear movement, perpendicularity of spindle axis and trueness of spindle rotation, must be of the highest order of accuracy.

Since a hole must have depth, accuracy in one plane is not sufficient. A phrase has been coined to project this requirement to include the space bounded by the vertical, as well as horizontal travel limits. That phrase is cubic concept of accuracy. It is within this space that all the inbuilt accuracy of the machine is transferred to the work.

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March 1952.

Even a high degree of accuracy under inspection conditions does not assure accuracy of production performance in a hole locating machine. This can be assured only by recognition, during design, of the numerous factors which can influence production accuracy.

For example, all of the inherent accuracy of a measuring system, capable of positioning the workpiece in relation to the spindle within a tenth, is rendered nearly valueless if the spindle itself does not retain its position during machining operations. See Fig. 2. Such a movement is inevitable, unless steps are taken during design to minimize or eliminate it.

Unfortunately, this manifestation of thermal effect is often either not recognized or is ignored, yet it is likely to introduce errors of from 0.001 to 0.002 in. in a day's operation. This condition cannot be remedied by placing the machine in a temperature-controlled room.

There are two effective means for overcoming this difficulty. The member supporting the spindle may be of Invar, an alloy of extremely low thermal expansion characteristics; or this member may be kept at constant temperature by some regulating system. When combined, these two features assure the ultimate in stability and accuracy.

A controversial issue exists in the choice of a measuring system in jig borers and jig grinders. However, since all measuring systems used in hole locating machines depend on the accuracy of a screw, and because a screw provides the only mechanical element capable of simultaneously measuring and positioning, it seems only logical to utilize this versatility and accuracy directly. In hole locating machines based on the lead screw principle, the functions of locating and positioning are combined, with a resulting increase in efficiency and a higher accuracy potential.

Naturally, good operating technique plays an important role in the accuracy of work on any hole locating machine. Design features which make good

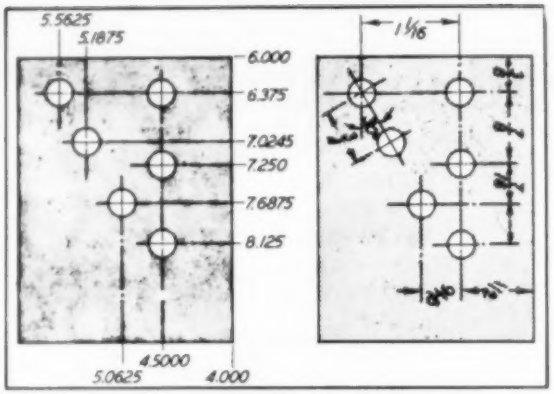


Fig. 1. The workpiece shown at the left is dimensioned according to coordinate principles while the workpiece at the right has been dimensioned by the conventional method.

practice the line of least resistance are important. For example, the best sequence is to rough all holes before finishing any of them. The greatest incentive to prevent an operator from short cutting this procedure is the speed and ease of positioning designed into the machine. Lead screws make it easier and quicker to follow the best practice.

Another seemingly obvious, though frequently neglected feature directly affecting accuracy lies in the method of clamping locating machine members. Not infrequently clamps for table, slide or spindle housing influence location by several tenths, when locked.

Maintaining Performance Accuracy. Probably the most subtle source of trouble in a jig borer or jig grinder is one which develops gradually, after the machine has established its reputation for performance accuracy. The source may be twofold: abnormally rapid wear and/or dimensional instability.

Premature wear may result from improper choice of materials, lack of adequate bearing area for moving parts, or an insufficiently high degree of surface finish. Lapped fits between members of close to carbide hardness, for example, preserve initial accuracy for many years.

Dimensional instability itself results from two basic conditions: gradual relaxation of locked-in stresses in castings and/or unstable hardened steel parts. The former may be effectively prevented by suitable stress-relieving cycles during the manufacture of the machine.

By far the least understood and therefore most frequently neglected source of progressive instability results from a gradual decomposition or change in the crystalline structure of hardened steel. Far from being an abstract and remote phenomenon, this is a very practical and important problem. Unless preventive steps are taken, hardened steel is subject to significant dimensional changes during its life. This change may be gradual over a period of months or years, or it may occur instantaneously. To make matters more confusing, it may either grow or shrink. This growth and shrinkage may occur together in an unstable equilibrium, or one phase may follow completion of the other.

In one instance a high quality gage block grew 50 millionths of an inch in a few months. This was verified by the National Bureau of Standards. An unstabilized lead screw 16 in. long has been observed to grow 0.0015 in. in a year and shortly afterward to shrink by half that amount.

The only cure for any of these forms of permanent instability is an adequate and effective stabilizing cycle applied to the parts.

Relation of Jig Boring to Jig Grinding. So far, the discussion has been limited to establishing the accuracy requirements of machines designed to accurately locate holes. At this point it might be well to expand the relationship of the jig grinder to the jig borer, before proceeding to the subject of operating practices.

The jig grinder, a relatively recent and specialized development warrants a comparison to the more generally familiar jig borer. The latter may be defined as a machine capable of accurately establishing the relationship of any desired point on

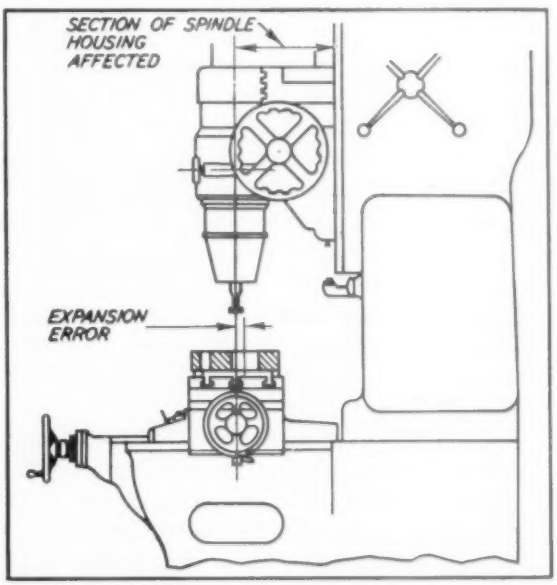


Fig. 2. A temperature rise in the spindle housing during operation causes expansion which displaces the spindle axle.

the workpiece and the axis of a simple spindle carrying a drill or boring tool. Its function is light milling and accurate hole location in soft materials.

While duplication of these functions in a jig grinder results in a general similarity of design, including identical measuring systems, modifications are necessitated by several factors: (1) Its work must be performed in hardened steel or car-

bide. (2) Additional features, such as taper and contour grinding are desirable. (3) It is always used on finishing operations having higher accuracy requirements.

In place of a boring tool, the jig grinder is provided with a high-speed grinding spindle planetarily mounted on the main spindle. See Fig. 3. This construction parallels the geometric accuracy of boring, and permits outfeed while grinding in sizing the hole.

In die work it is desirable to grind draft or taper

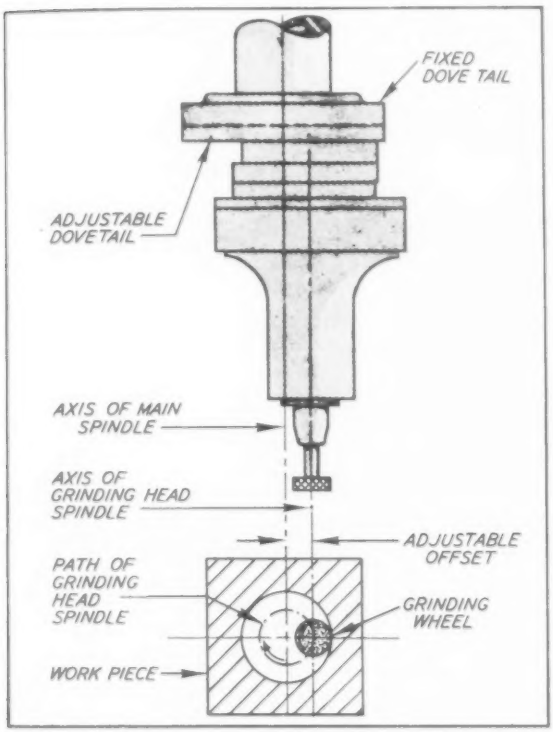


Fig. 3. Planetary movement results from eccentric positioning of the high-speed spindle relative to the axis of the slow-speed main spindle. The latter determines the axis of the hole. This construction permits outfeed.

in the same setting as the hole. To permit this, two methods are in general use. The downfeed of the main spindle can be interlocked with the outfeed of the grinding head as shown at the left in Fig. 4. This necessitates a taper-dressed wheel and the attendant danger of wheel shank interference with the top edge of the hole. Attempts to avoid this limitation have resulted in the use of a supplementary wedge-shaped piece used to tilt the grinding head. The axis upon which reciprocating member and grinding head move may be inclined to the desired angle as shown at the bottom in Fig. 4. This permits the use of cylindrical wheels, avoids shank interference and eliminates the need for auxiliary parts.

The jig grinder was originally designed to grind cylindrical and tapered holes in location. The rapidly increasing trend, particularly in die making,

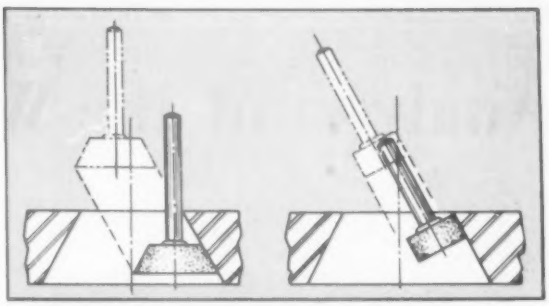


Fig. 4. To grind a taper, when outfeed is related to downfeed, the wheel must be dressed as shown at the left, with the possibility of interference of the shank. This interference may be eliminated by tipping the grinding spindle itself.

toward contours completely ground to figures rather than to fit a mating part led to the application of the jig grinder to that operation. With certain design changes and modifications, the new jig grinder is widely used for contour as well as hole grinding.

Comparative accuracy between the jig borer and jig grinder is often misunderstood and requires clarification. Both are built to exactly the same standards as to measuring system and geometry.

When the borer is used to locate holes before hardening and subsequent jig grinding, shortcuts in time and accuracy are often employed. The anticipated hardening distortion makes it unnecessary to hold size or location to the last ten-thousandth inch, although even under such conditions the result is more accurate than by makeshift methods, and this is important so that a minimum amount of stock need be left for grinding. Used on final locating and sizing operations, the borer provides the highest accuracy possible in soft material.

The somewhat greater accuracy of the jig grinder is largely due to the fact that it is possible to grind and measure hard material more accurately than soft material can be machined and measured. This is fortunate, since the jig grinder is used only on finishing operations. Because grinding is a slower operation, and work remains in the machine longer than in a borer, temperature becomes a vitally important factor. In addition to controlling the location of the spindle as previously described, cool exhaust air from the air-driven grinding head is employed to avoid excessive temperature rise in the work during grinding.

Attempts have been made to make a drill press or milling machine serve as a jig borer or jig grinder merely by adding a measuring system. There are compromise solutions to the hole location problem in the form of such conversions, which can be justified by budget. Within their recognized limitations, they certainly represent an improvement over the more makeshift layout methods.

(Continued next month)

Analysis of the Wedge Jack

By Zbigniew Jania
ALPHA ENGINEERING COMPANY

THIS MECHANISM finds extensive application in tool engineering in a variety of work-holding fixtures and locking or clamping devices. Although in many cases it can be built and will give satisfactory performance without too much design work, it would, in many instances, be advantageous to be able to calculate the optimum wedge angle and angle of inclination (if it can be changed) of the two blocks. This procedure would be particularly useful when efficiency of arrangement and mechanical advantage are important, which frequently occurs when designing relatively large work-holding fixtures.

Referring to Fig. 1, force f_A in block *(A)* is to be overcome by a force f_B applied to *(B)* as shown. Line *XY* is the line of contact of (*A*) and (*B*). The angle at which (*A*) is inclined with respect to (*B*) is Θ.

Let μ_o = coefficient of friction between (*A*) and (*B*)

μ = coefficient of friction between the blocks and their guides

$\phi_o = \tan^{-1} \mu_o$ = friction angle corresponding to μ_o

$\phi = \tan^{-1} \mu$ = friction angle corresponding to μ

Forces acting on (*B*) are

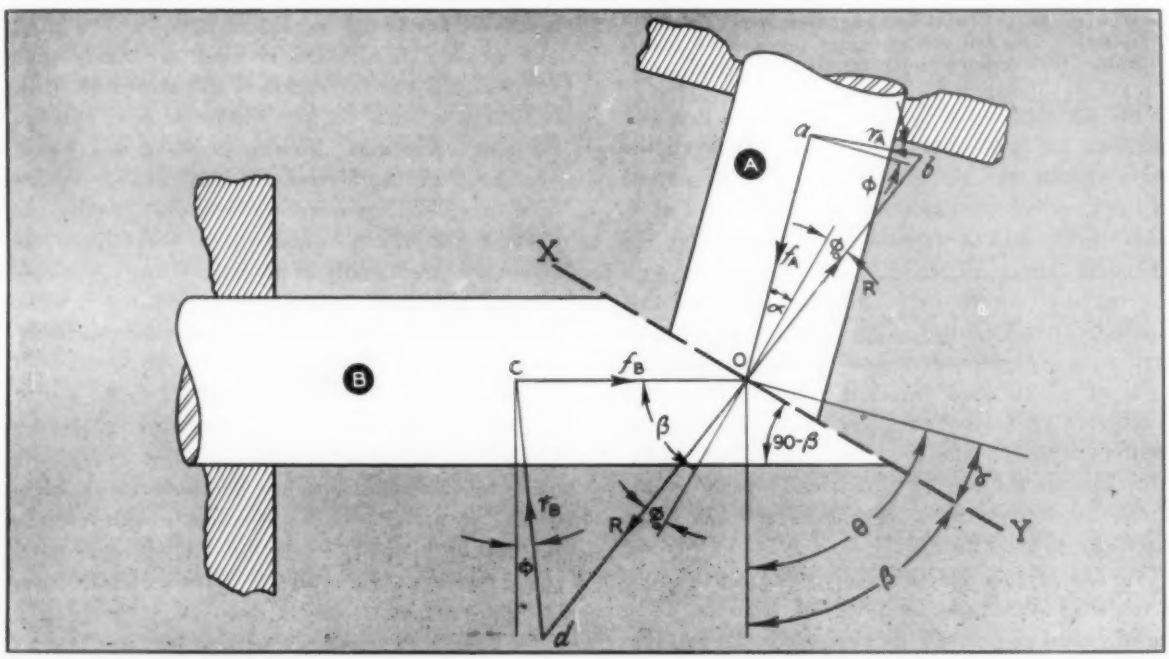
(1) reaction (*R*) (common to (*A*) and (*B*)
(2) applied force f_B
(3) reaction in guides r_B

These form a triangle of forces *Ocd*. Similarly forces acting on (A) form triangle *Oab*.

From triangle *Ocd*,

$$\frac{f_B}{\sin \angle \text{Odc}} = \frac{R}{\sin \angle \text{Ocd}}$$

Fig. 1. The diagram shows the forces which act on each of two blocks, which are representative of the members of a wedge jack.



or $$\frac{R}{f_B} = \frac{\sin \angle \text{Ocd}}{\sin \angle \text{Odc}}$$

$$= \frac{\sin (90^\circ - \phi)}{\sin \{ 90^\circ - (\beta - \phi_o - \phi) \}}$$

$$= \frac{\cos \phi}{\cos (\beta - \phi_o - \phi)} \quad (1)$$

similarly

$$\frac{R}{f_A} \frac{\cos \phi}{\cos (\alpha + \phi_o + \phi)} = \quad (2)$$

Dividing (2) by (1)

$$\frac{f_B}{f_A} = \frac{\cos (\beta - \phi_o - \phi)}{\cos (\alpha + \phi_o + \phi)} \quad (2a)$$

or

$$f_B = f_A \frac{\cos (\beta - \phi_o - \phi)}{\cos (\alpha + \phi_o + \phi)} \quad (3)$$

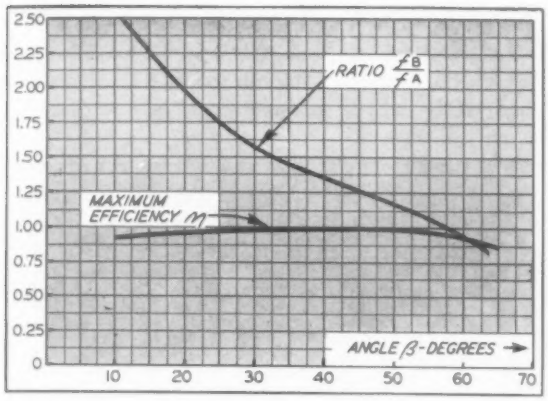


Fig. 2. This graph, for a constant value of of $\theta = 60$ deg., the variation of ratio f_B/f_A and of maximum efficiency for a given value of β is shown.

The efficiency of the arrangement is 100 percent when friction is neglected. Equation (3) then is

$$f'_B = f_A \frac{\cos \beta}{\cos \alpha} . \quad (3a)$$

The efficiency of the wedge jack (considering effect of friction) clearly is:

$$\eta = \frac{f_B}{f'_B} = \frac{\cos \beta \cos (\alpha + \phi_o + \phi)}{\cos \alpha \cos (\beta - \phi_o - \phi)} \quad (4)$$

Eliminating angle α from equation (4)

$$\alpha = \theta - \beta$$

and changing the product of two cosines to a sum of cosines by means of trigonometric identity

$$\cos A \cos B = \tfrac{1}{2} \{ \cos (A - B) + \cos (A + B) \}$$

the following relationship is obtained:

$$\eta = \frac{\cos \beta \cos (\theta - \beta - \phi_o - \phi)}{\cos (\theta - \beta) \cos (\beta - \phi_o - \phi)}$$

$$\frac{\cos (2\beta - \theta - \phi_o - \phi) + \cos (\theta + \phi_o + \phi)}{\cos (2\beta - \theta - \phi_o - \phi) + \cos (\theta - \phi_o - \phi)} \quad (5)$$

If θ, ϕ_o and ϕ are held constant, as is usually the case, the expression for η as given by equation (5) is a maximum when

$$\cos (2\beta - \theta - \phi_o - \phi) = 1$$

or

$$2\beta - \theta - \phi_o - \phi = 0$$

whence, for η to have maximum value

$$\beta = \frac{\theta + \phi_o + \phi}{2} \quad (6)$$

The value obtained for β when substituted in equation (5) gives

Maximum efficiency $= \eta_{max}$

$$= \frac{\cos (\theta + \phi_o + \phi) + 1}{\cos (\theta - \phi_o - \phi) + 1} \quad (7)$$

It is evident from equation (3) that for a given value of f_B, maximum force in (A) is obtained when $\alpha = 0$, and $\beta = \theta$. Considering equation (3a), maximum force would be obtained when $\alpha = 0$ also. However, when $\theta = 90^\circ$ the equation for maximum force derived from equation (3a) does not hold due to the face that expression

$$f_A = f_B \frac{\cos \alpha}{\cos \beta}$$

becomes discontinuous when $\alpha = 0$ and $\beta = \theta = 90^\circ$, but equation (3), where the effects of friction are taken into account still applies.

Equations (2a) and (4) are used to plot graphs (1) and (2). See Figs. 2 and 3.

In graph 1, for a constant value of $\theta = 60^\circ$, the variation of ratio f_B/f_A and of maximum efficiency for a given value of β is shown. Graph 2 shows variation of f_B/f_A and η with β when $\theta = 90^\circ =$ constant.

In plotting these graphs the following values for coefficients of friction have been assumed

$$\mu_o = 0.15; \ \phi_o = \tan^{-1} 0.15 = 8^\circ\ 32'$$
$$\mu = 0.1 \ ; \phi = \tan^{-1} 0.1 = 5^\circ\ 43'$$

Both graphs show that both efficiency and mechanical advantage are adversely affected by small values chosen for β.

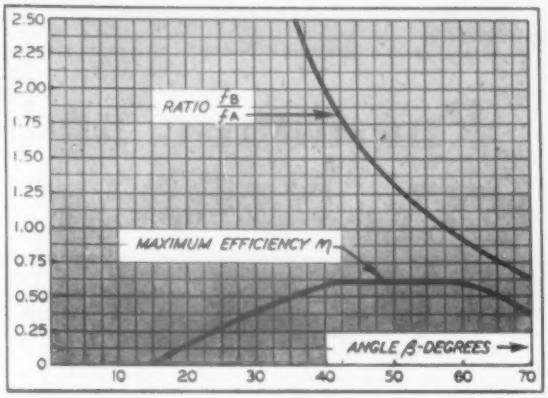


Fig. 3. This graph shows the variation of f_B/f_A and η with β when $\theta = 90^\circ =$ constant.

Pneumatic and Hydraulic Drives

By John C. Hanna

VICE PRESIDENT AND CHIEF ENGINEER
HANNA ENGINEERING WORKS

Part II

THERE MAY BE some danger of air or oil passing around the piston packings. This condition may be met by a cylinder embodying the principle of Fig. 7. In this design any air or oil leakage past the piston packings is exhausted through the bleeder vent.

Master and Slave Cylinders for Remote Control. Fig. 8 illustrates an application of hydraulics which has infinite variations. Power is supplied to the master cylinder through a manual lever or a motor. Depending upon the relative size of the two cylinders, the slave-piston movement is proportional to that of the master cylinder. Use of oil in the circuit assures smooth, positive control of the slave piston. Since the master and slave cylinders can be located in any relative positions, the advantage of remote control is of special importance.

The position of the slave piston in its stroke may be adjusted individually by means of the stop valve. This valve also functions to rid the system of air.

Speed Control by Oil. Another approach to the problem of supplying smooth positive power with air is presented in Fig. 9. Although compressed air supplies the power, the advantages of oil control are realized. Oil pressure is maintained near line pressure so that leakage from the air to the oil cylinder is prevented. This danger appears only at the air-oil piston rod packing.

With practical applications in mind, the arrangement shown is quite flexible for the following reasons: The slave cylinder can be located far from the master oil and air cylinders; the air and master oil cylinders can have different diameters with the same stroke; and providing the volume displacements are equal, the master and slave oil cylinders can have different dimensions. Most important is the fact that the slave cylinder can be located in a remote and confined space.

In Fig. 10 a cross slide is moved by a double-acting air cylinder. The purpose of the hydraulic cylinder is to act as a speed control or damping device, thus assuring smooth positive motion of the cross slide, which in this case is in one direction.

Presented at the 20th Annual Meeting of American Society of Tool Engineers, March, 1952.

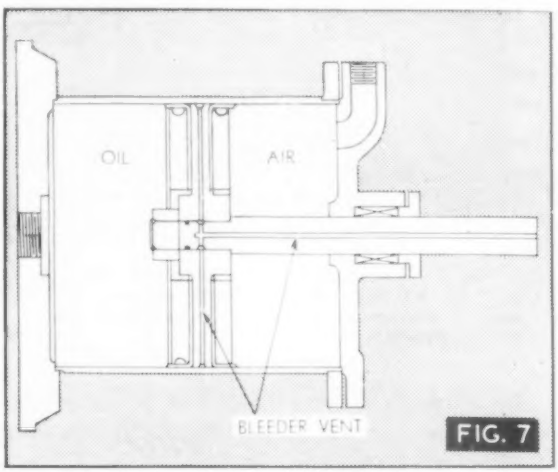


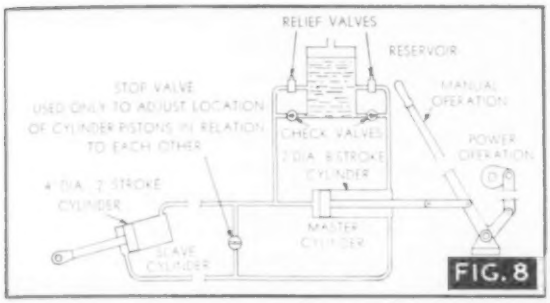
Fig. 7. In this type of cylinder, the leakage of any air or oil past the piston packings is exhausted through the bleeder vent.

Three-Position Cylinder. The three-position cylinder illustrated in Fig. 11 has the unique advantage of allowing three positive positions of the rod. By providing pressure at both ports *A* and *C*, the rod assumes its center position, as shown, due to a resultant force arising from the differential in piston areas. Pressure at port *C* delivers the rod to its farthest withdrawn position. With pressure at port *B* the rod is fully extended.

This type of cylinder has a wide variety of applications. Several examples may indicate the possibilities: as a shifting mechanism for a three-speed drive; as an actuator of a triple-position valve; or as an integral member of a two-speed-and-release clutch.

Roll-Over Mechanisms. Often it is necessary to turn a load over or take it from a higher level and place it in another spot. Three possible methods of lifting and swinging a load in a 180-degree arc by compressed air energy will be presented.

The circuit in Fig. 12 serves the purpose using air to power and oil to control the stroke. The difficulty inherent in swinging a load about a point is that the resistant torque is greatest at the horizontal and decreases until at the top of the stroke gravity



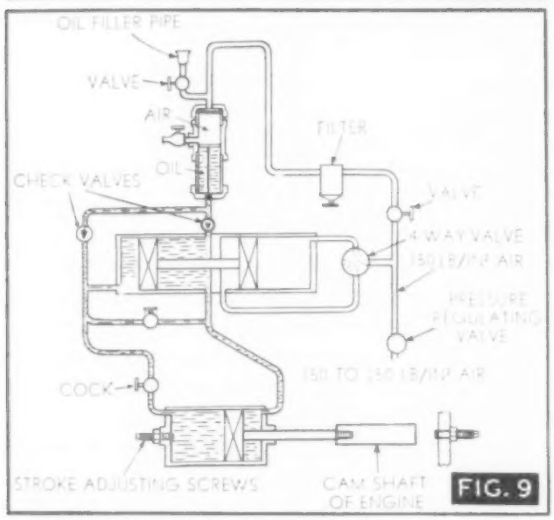
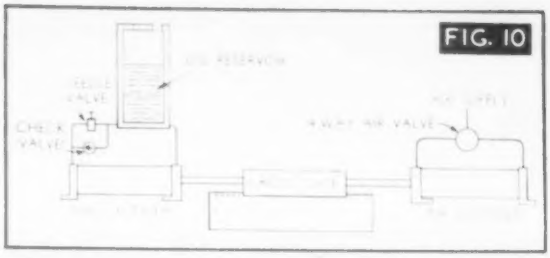


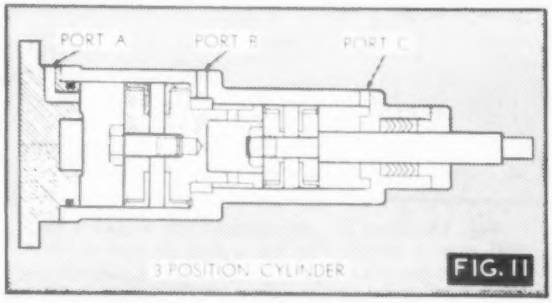
Fig. 8. The hydraulic application shown here has infinite variations. A slave oil cylinder is controlled from a master oil cylinder. The two cylinders can be located in any relative position.

Fig. 9 illustrates another approach to the problem of supplying smooth positive power with air. Although compressed air supplies the power, the oil control advantages are realized.

begins to work with the cylinder. From the diagram it can be seen that the cylinder and gravity join in slamming the load down. With the constantly increasing velocity, the important braking force throughout the stroke is the oil cylinder. Along with the needle valves, this cylinder acts as a damping mechanism. There is definite waste of air power. Furthermore, the damping device does not suit the motion and forces involved.

Air Motor. A rotary air motor is a means of efficiently overcoming a variable resistance. This motor, as is true for a hydraulic motor or pump, has no memory. A lack of memory indicates that it can act against a very slight resistance with no more





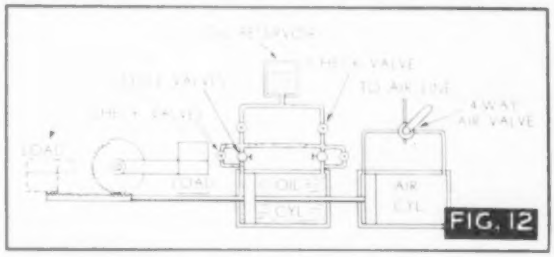


Fig. 10 shows a cross slide which is moved by a double-acting air cylinder. The hydraulic cylinder acts as a speed control or damping device.

Fig. 11 illustrates a three-position cylinder which has a wide variety of applications including: a shifting mechanism for a three-speed drive; an actuator of a triple-position valve; an integral member of a two-speed-and-release clutch.

Fig. 12. The circuit uses air for power and oil to control the stroke for swinging a load in a 180-degree arc such as in moving the load from a higher to a lower spot or to turn it over.

than just enough air pressure to overcome this resistance, and then use air at high pressure against a high resistance with no penalty for previous motion. In the respect that it will move rapidly against a low resistance, the air motor resembles the air cylinder. But with no memory, the air motor can be regulated for speed by manual or automatic throttling much more easily than can an air cylinder bucking a similar resistance.

The air motor has a wide range of useful speeds which is duplicated only at the expense of considerable complexity by ordinary alternating current in one horsepower motors and above, and only at considerably higher capital outlay.

Fig. 13 shows an air motor geared directly to a rotating arm. In this case the burden of speed control is placed upon throttling the air.

An actuating mechanism consisting of only one cylinder and more nearly meeting the dynamics of the operation is the roll-over mechanism shown in

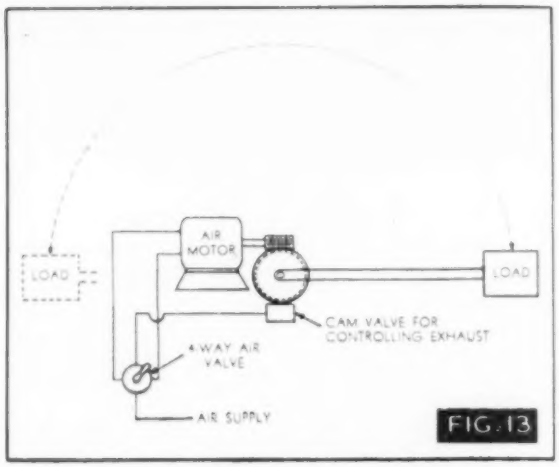


Fig. 13 shows an arrangment for a motor to roll over a load. The air motor is geared directly to the rotating arm. In Fig. 14 (below) the cylinder is single-acting, working only on the pull stroke.

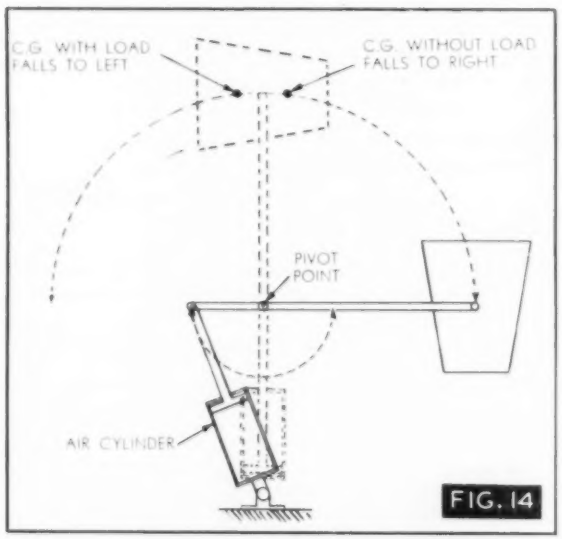


Fig. 14. The cylinder is single-acting, working only on the pull stroke. When the load has passed top dead center, a speed control valve on the exhaust air line transforms the cylinder into a braking device. The roll-over mechanism capitalizes on a two-position center of gravity which changes with the arm load. Assuming the arm to be in a vertical position, the following must be true: The center of gravity of the load and bucket and that of the bucket alone must be on opposite sides of the center line of the arm through the pivot point. If this were not the case the arm would simply be forced to the vertical position and return to its original position, doing no useful work; or the arm might remain in a vertical position.

Even more positive control of the arm could be developed by inserting a short cushion at the top of the cylinder and a long cushion at the bottom.

Guides for Selection. In many instances, the tool engineer must make a choice between the various means of power. Entering into this decision are a number of factors which must be weighed carefully.

Frequently a manufacturing plant has a compressed air system, but plants with centralized hydraulic systems are few. As a result, hydraulics is often discarded as a source of power because one installation requires designing and building an entire system. Hydraulic power units available on the market are increasing in popularity as a solution to this problem. These units combine several components in a comparatively small package—pump, motors, valves, filters, manifolds, reservoir, controls, etc. However, the initial cost of a hydraulic system is higher than the pneumatic.

Still other factors must be considered from the cost angle. The efficiency of power transmission in the hydraulic system is superior. Since higher pressures are possible with oil, smaller equipment will be required to meet energy demands.

From the maintenance point of view, the oil system is self-lubricating. As a general rule, the design of hydraulic cylinders is such that repacking pistons is unnecessary although often a "must" in the pneumatic types. Assuming cleaning and dehumidification, air is non-corrosive to metals or packings. Air leaks do not cause trouble unless sufficient energy loss is incurred. Air possesses the added advantage in that repairs can be made without draining the system.

The overall weight of the pneumatic system is slightly lower. Return lines are often not required, while in hydraulics the system is usually closed.

The safety engineer is most concerned with the combustible properties of the working fluid. Of course, air holds the upper hand here although non-inflammable hydraulic fluids are now on the market.

Due to the practically incompressible nature of oil, positive displacement with a given fluid volume is possible. Hydraulics provides smoother and more closely controlled movement. Then, there is the extremely important point that higher pressures and thus greater forces are practical with oil.

The characteristics of the fluid, air, mean a comparatively free flow. Also, the viscosity of air is not seriously affected by temperature changes. This faster acting medium, once compressed, stores its energy for immediate delivery at any time, in large quantity per second.

It was mentioned above that the tool engineer often uses air where pump hydraulics would be more ideal. The logic is that if air is available in ample quantities, the capital outlay for air will be much less than for pump hydraulics. In addition, an air system is often less clumsy, weighs less and is more easily applied. If the tool engineer calculates the total amount of air he will use in a year, he will find that the higher cost of air over oil will not amortize the capital outlay for oil over many, many years.

Statistical Evaluation of Rational and Stratified Methods of Sampling

By Dr. James V. Strela
STAFF STATISTICIAN
THOMPSON PRODUCTS, INC.

Part II

THE RELATION of n to reliability of standard determinations is shown in Fig. 2. An analysis and interpretation of ranges follows.

Analysis and Interpretation of Ranges

***n* = 5.** Note that, for example, the range of the first sample is located on the scale of values from minus 4 to plus 2 and thus is asymmetrical in respect to the value zero which corresponds to the assumed quality specification mean. On the other hand, the $\overline{X} \pm 3\sigma$ of this small sample is practically symmetrically distributed in respect to the same reference value zero. Furthermore, note how much beyond the spread of the sample range the spread of this $\overline{X} \pm 3\sigma$ is extended and how, therefore, it corresponds more closely to the natural limits of variability previously derived from the large sample of 500 values.

***n* = 50.** The same analysis applies to this larger sample, except that on account of its increased size, its distribution represents a truer picture of the symmetrical distribution of its parent population. It is to be noted that the $\overline{X} \pm 3\sigma$ still extends beyond the sample range, although less than was the case in the preceding sample.

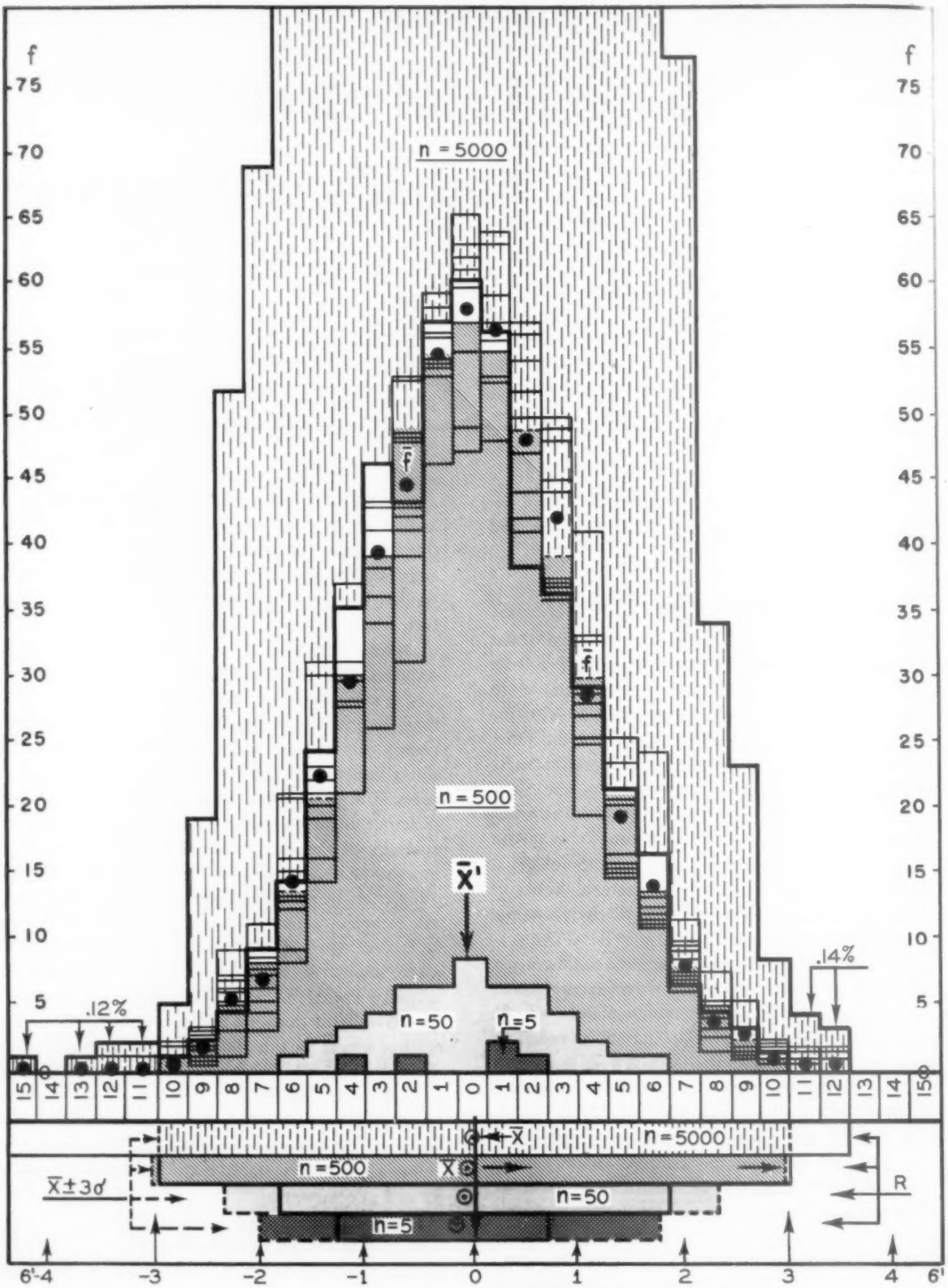
***n* = 500.** Here, the $\overline{X} \pm 3\sigma$ is practically identical with the range of the sample. Consequently, if this situation is typical of the whole process, we may say that this sample size is an optimum sample size from which the true standard of this process may be determined on the basis of the prima facie evidence of the sample as well as on the basis of its statistical analysis. This statement may or may not be true, for an optimum sample size cannot be precisely determined.

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March, 1952.

***n* = 5,000.** The situation is now reversed as far as the range of this huge sample and its $\overline{X} \pm 3\sigma = 0 \pm 10.5$ are concerned. The latter dispersion is considerably narrower than the range of the sample, limited by the values minus 15 and plus 12. This fact, which is typical of the controlled processes, is of special importance, for it indicates that if the occurrence of the values beyond the range of $\overline{X} \pm 3\sigma'$ is viewed as an evidence of the excessive variation resulting from the operation of the assignable causes of variation which are subject to detection and elimination, in $100 - 99.73 = 0.27$ percent of cases, it may seem the small portion of the normal distribution due to chance causes of variation are evidence of the abnormal variation resulting from non-existent assignable causes of variation. This is quite true; however, since usually only a few values are sampled, occurrence of the values beyond the $\overline{X}' \pm 3\sigma'$ (previously established and accepted as a true standard) will, in 99.73 percent of the cases, actually reveal an assignable cause of excessive variation or of the shift of the original level of operation which, in this illustration, is represented by the value zero. In other words, adopting the $\overline{X}' \pm 3\sigma'$ limits of variability as a dividing point between the chance and assignable causes of variability may involve 0.27 percent of wasteful effort. Such percentage being very small, these limits are statistical as well as economical.

It is the spread within the $\pm 3\sigma$ limits of a huge sample that is used in the technique of quality control as a starting point. Consequently, on the basis of the analysis of the 5,000 values, which is a sample sufficiently large to be viewed as representative of the whole universe, the following standard is now established.

$$\overline{X} = 0.0165 = 0 \text{ for practical purposes} = \overline{X}'$$
$$\sigma = 3.49 = 3.5 = \sigma'$$



Values 15 to 0 in the left portion of the scale of the values X are negative values.

Fig. 2. Relation of *n* to reliability of standard determinations ($\bar{X}\sigma'$). (This figure is published again this month for the reader's convenience, since the greater portion of Part II of this article deals with a discussion of this figure. It was stated last month that the horizontal bars on the bottom of the figure, bordered by the full heavy perpendicular lines, recapitulate the ranges of the four samples plotted above their scale of values. The widths of the bars limited by the dotted lines represent the $\bar{X} \pm 3\sigma$ of these samples. The $\bar{X}$ value of each sample is illustrated by the hollow circle with a dot.)

The $\bar{X} \pm 3\ \sigma$ of this large sample is now considered as the true $X' \pm 3\ \sigma'$ of the whole population. In other words, when the estimate is based on a very large sample, it is viewed as if it were a true standard, although such a standard is never precisely known and changes with the inclusion of practically any additional value, even if only minutely.

From the well-established values of the mean and standard deviation of a controlled process, it is possible to calculate the 3σ limits of variability of the averages, ranges, and standard deviations of the samples of n values conforming to the same process. In such computations, use is made of certain factors, the most important of which are subsequently derived in this paper. At this point, however, it must be emphasized that those factors are derived from the statistical properties of the normal distribution, for the equation describing the normal law of variation due to chance causes is so designed that it represents the fundamental law which describes the distribution of many, but definitely not all, quantitative data from repetitive industrial operations. Also of interest is the normal law of distribution because the procedures employed in generalizing the results from the study of samples, and especially determining the reliability of such generalizations, lean principally on the law embodied in that equation. The equation reads

$$(3) \qquad y = \frac{N}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{x^2}{2\sigma^2}}$$

The meaning of the symbols is as follows:

y is the dependent variable represented by the frequency of values X erected above any point on the scale of the independent variable X.

x is the independent variable represented by the values X expressed as the magnitude of the deviation of such values and the true mean of their distribution $(x = X - \bar{X})$.

σ is the standard deviation of values X.

π is the constant 3.14159.

e is the base of the Napierian logarithms having the value of 2.71828.

Since at the mean of the normal curve the values $x = X - \bar{X}$ become 0, at the mean the equation of the normal curve reads:

$$(3a) \qquad y = \frac{N}{\sigma\sqrt{2\pi}} = y_o = \text{maximum frequency at } \bar{X}$$

Since $\sqrt{2\pi} = 2.5066$, the y_o equation at $\bar{X}$ may be written as:

$$(3b) \qquad y_o = \frac{N}{2.5066\sigma}$$

Finally, the integral:

$$(4) \qquad \int_{-\infty}^{\infty} \frac{N}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{x^2}{2\sigma^2}} = 1.00 = \text{total area} = 100 \text{ percent.}$$

$$(4a) \qquad \int_{-3\sigma}^{3\sigma} \frac{N}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{x^2}{2\sigma^2}} = 0.9973 = 99.73$$

percent of a controlled process.

Although practically all analyses presented in this paper depend on the application of the above equations, the table of ordinates and of the fractional areas under the normal curve for the ratios $x/\sigma = (X - \bar{X})/\sigma$, calculated from the above equations are not presented; those tables and the guidance to their application are to be found in any text on statistics. Nevertheless, since in quality control literature the normal curve is constantly mentioned but seldom documented by a sufficiently large distribution of values, an attempt is made in Fig. 2 to demonstrate empirically the existence of the normal law of distribution. This was accomplished as follows:

Ten samples of 500 values from the Thompson sampling machine were secured and their organized frequency distributions by class intervals in the units of one were recorded. The heavily drawn frequency distribution of 500 values in Fig. 3 represents the first of these ten samples. It is the analysis of that sample which is represented by the range and the $\bar{X} \pm 3\ \sigma$ dispersion pictured in the third horizontal bar at the bottom of the figure.

The class interval frequencies of the remaining nine samples are indicated by the nine thinner horizontal lines, except in the class intervals far removed from the mean value zero, in which the values under consideration did not appear at all or only a few times. It is to be noted that some of these horizontally charted frequencies are crowded as if they were mixed numbers. But this is a mere compromise device of charting several identical frequencies rather than indicating by a number how many times such frequencies occurred in the class intervals under consideration.

The averages of all ten frequencies are represented by the solid dots. However, those dots also represent the actual class interval frequencies in the combined sample of 5,000 values, if drawn to a scale ten times smaller than the one used in the figure.

Analysis and Interpretation of Distribution

Since the sequence of the class interval frequencies in the case of the nine samples is obliterated, the conformance of only the first sample to the perfectly symmetrical normal distribution need be tested. The distribution under consideration is that drawn in very heavy lines. It is to be noted that even this sample of 500 values departs considerably from the ideal pattern of its parent population. (The same would be found true about the remaining nine samples.)

However, if the solid dots were connected and a

TABLES 1 and 1a

1. Factors for estimating σ′ from $\overline{R}$ or $\overline{\sigma}$ of *m* sub-groups of *n* values X.

1a. Factors for determining from σ′, $\overline{R}$, or $\overline{\sigma}$ of *m* sub-groups of *n* values X the 3 σ control chart limits for value X and $\overline{X}$.

Table:	1		1a				
Chart for:	X		X		$\overline{X}$		
Estimated from:	$\overline{R}$	$\overline{\sigma}$	$\overline{R}$	$\overline{\sigma}$	σ′	$\overline{R}$	$\overline{\sigma}$
Factor:	d_2	c_2	I_2	I_3	A	A_2	A_1
n = 2	1.128	0.5642	2.660	1.128	2.121	1.880	3.759
3	1.693	0.7236	1.772	1.693	1.732	1.023	2.394
4	2.059	0.7979	1.457	2.059	1.500	0.729	1.880
5	2.326	0.8407	1.290	2.326	1.342	0.577	1.596
6	2.534	0.8686	1.184	2.534	1.225	0.483	1.410
7	2.704	0.8882	1.109	2.705	1.134	0.419	1.277
8	2.847	0.9027	1.054	2.846	1.061	0.373	1.175
9	2.970	0.9139	1.010	2.970	1.000	0.337	1.094
10	3.078	0.9227	0.975	3.077	0.949	0.308	1.028
11	3.173	0.9300	0.945	3.175	0.905	0.285	0.973
12	3.258	0.9359	0.921	3.257	0.866	0.266	0.925
13	3.336	0.9410	0.899	3.337	0.832	0.249	0.884
14	3.407	0.9453	0.881	3.405	0.802	0.235	0.848
15	3.472	0.9490	0.864	3.472	0.775	0.223	0.817
σ′ Estimates	$\sigma'_r = R/d_2$	$\sigma'_s = \overline{\sigma}/c_2$					
CONTROL CHART FORMULAE							
(1) Central line:			$\overline{\overline{X}}$	$\overline{\overline{X}}$	$\overline{X}'$	$\overline{\overline{X}}$	$\overline{\overline{X}}$
(2) U. C. L.			$\overline{\overline{X}} + I_2\overline{R}$	$\overline{\overline{X}} + I_3\overline{\sigma}$	$\overline{X}' + A\sigma'$	$\overline{\overline{X}} + A_2\overline{R}$	$\overline{\overline{X}} + A_1\overline{\sigma}$
(3) L. C. L.			$\overline{\overline{X}} - I_2\overline{R}$	$\overline{\overline{X}} - I_3\overline{\sigma}$	$\overline{X}' - A\sigma'$	$\overline{\overline{X}} - A_2\overline{R}$	$\overline{\overline{X}} - A_1\overline{\sigma}$

Above factors are based on the normal distribution

smooth curve drawn, they would yield an almost symmetrical bell-shaped curve symbolizing the normal distribution. This is equivalent to saying that a huge sample may practically coincide with its parent population in shape.

To prove the above assertion, from the table based on the equation (3b) a normal curve based on $\sigma = 3.5 = \sigma'$, characterizing the Thompson sampling machine was erected at $\overline{X} = \overline{X}' = 0$ in Fig. 2 and was shaded with the slanting lines. Consequently, the vertical distances between the centers of the dots representing the average class interval frequencies of the ten samples and the tops of the shaded bars representing exactly the normal distribution of cell frequencies based on $n = 500$ and $\sigma = 3.5$ are a graphic expression of the departures of the individual class interval frequencies of this average sample size of 500 values and their theoretical cell frequencies. Although the numerical analysis is not presented, it is to be emphasized that in only three class intervals was the departure between the two frequencies more than a whole unit. In other words, the normal law definitely governs the distribution of values produced by this process; however, its operation may be fully revealed only through a huge sample, preferably even much larger than 5,000 values, if a still closer conformance to the existing, but seldom, if ever, fully-known pattern of distribution of the values produced by a continuous process is to be reached.

It is also to be stressed that all theoretical frequencies under consideration are mixed numbers and are thus unattainable. In short, a perfectly normal distribution must always remain a mathematical abstraction of a statistical, and not purely mathematical, law governing the distribution of values from the realms of physical, biological, and social phenomena. Consequently, the law applies only on the average and in the long run. Its existence must be either accepted without proof or, if a proof is desired, much more sampling than is usually economically feasible must be conducted. In industrial practice, the evidence indicating either conformance or lack of conformance to the normal pattern of distribution which, in quality control, also symbolizes a state of control or a lack of it is usually accepted.

It is to be particularly noted that the 6 and 7 values outside the $\overline{X} \pm 3\sigma$ of this huge sample of 5,000 values conform to the equation (4a), for they constitute only 0.26 percent of the total number of 5,000 values as compared to the 0.27 percent of the area of the perfectly normal curve outside the $\overline{X} \pm 3\sigma$ due to chance causes of variation. By inference, then, in spite of the minor departures of the huge sample from the assumed perfectly normal pattern of its parent population, for practical purposes, the agreement is perfect.

By inference, again, because of the smallness of the first sample of only 5 values, it is absolutely impossible to expect that sample to conform to the normal distribution in the sense the large sample of 5,000 values did. On the other hand, as illustrated by the closer and closer conformance to the

rmal distribution of the progressively larger mples of 50 and 500 values, such conformance n eventually be reached by a long series of small mples. The quality control chart technique now be presented is based on this very assumption. ndamentally, the technique is so designed that it akes statistical allowances for the shortcomings the samples according to their size, as compared ith the full pattern of their parent population.

X and R Charts Based on Known and Estimated Standards

Test of Conformance to a Known or Reliably Estimated Standard (Fig. 2). Now that the $\bar{X}' \pm 3\sigma' = 0 \pm 10.5$ is viewed as a well-established standard characterizing the process under investigation, the reliability of the statistical tools developed from the properties of the normal distribution to testing the conformance of the values subsequently produced to that standard will be illustrated. (However, since in Fig. 2 only averages and ranges of the ten samples (m) of $n = 2, 5, 10,$ and 15 values from the Thompson sampling machine are analyzed, the conformance of the distribution pattern of the individual values estimated from these samples is tested in Fig. 3.

First, the two diagrams adjoining the scale of averages ($\bar{X}$) and ranges (R) of these four sets of samples will be analyzed. The heavy horizontal lines in the upper section represent the $\bar{X} \pm 3\sigma'/\sqrt{n} = \bar{X}' \pm A\sigma'$ as the $\pm 3\sigma_{\bar{X}}$ limits of variability within which the averages of n values characterized by the process having $\bar{X}' = 0$ and $\sigma' = 3.5$ should be located to give an indication that the parent population of the individual values from which these samples were taken remained fundamentally unchanged. Obviously, the formula used assumes that the distribution of the averages of n values is also normal but that the $\sigma_{\bar{X}}$ (sigma of the averages of n values X) decreases as the sample size increases and that the grand average of such sample averages ($\bar{\bar{X}}$), in the long run, coincides with the mean of the whole population of the individual values ($\bar{X}'$).

A similar relationship as the one between the σ' and $\sigma_{\bar{x}}$ also exists between the σ' and the σ_R (sigma of ranges of n values X), except that such σ_R increases as the sample size increases. However, the $\sigma_R = k\sigma'$ and the value of k is also a function of the sample size, n. The values of the four $\bar{R}'$ (theoretical average ranges of n values based on the known standard, σ') and the $\pm 3\sigma_R$ about them ($D_2\sigma' = U.C.L._R$ = Upper Control Limit for Ranges and $D_1\sigma' = L.C.L._R$ = Lower Control Limit for Ranges) pictured adjacent to the scale of values R, are also derived on the basis of this relationship.

In Fig. 2, the respective central lines $\bar{X}'$, $\bar{R}'$ and $\pm 3\sigma_{\bar{X}}$ and $\pm 3\sigma_R$ based on the known standard are extended as thin solid or dotted lines into the four sections of the body of the figure as the zones of variability within which 99.73 percent of the averages and ranges of the four sets of sample sizes selected should be located if the values on which such averages and ranges are based are to present evidence of conforming to the standard $\bar{X}' = 0$ and $\sigma' = 3.5$ on which these central values and the 3σ limits about them are based. Such conformance is very clearly indicated; there is not a single average or range outside the respective control chart limits determined from the past standard. Obviously, each control chart for averages and ranges of the values sampled also consists of 3 lines: (1) central line, represented by the average mean ($\bar{\bar{X}}$) and range ($\bar{R}$) of the m subgroups of n values and (2,3) the $\pm 3\sigma_{\bar{x}}$ and $\pm 3\sigma_R$ about them; the latter two are called the upper (2) and lower (3) limits for averages and ranges of such samples.

Note that these central lines (represented by the heavy full lines = $\bar{\bar{X}}$ and $\bar{R}$) do not differ appreciably from their theoretical values ($\bar{X}'$ and $\bar{R}'$) based on the known standard (thin full lines). Of special interest are the values of the four grand averages, $\bar{\bar{X}}$, customarily referred to as process averages, illustrated by the heavy full lines in the upper section of the figure. Although they are based on the averages, $\bar{X}$, of ten samples, they must still be viewed as four single averages of $N = m\,n = 10n = 20, 50, 100,$ and 150 values, respectively; consequently, they should not depart more than $\pm 3\sigma'/\sqrt{N} = \pm 10.5/\sqrt{N}$ of the four combined samples of the sizes indicated from the $\bar{X}' = 0$. In the diagram adjoining the scale of values X, such $\bar{X}' \pm 3\sigma'/\sqrt{N}$ or $\bar{X}' \pm 3\sigma_{\bar{\bar{x}}}$ are pictured by the step-like diagram, the horizontal lines of which are also extended into the body of the figure as thin dotted lines to test the conformance of $\bar{\bar{X}}$ to $\bar{X}'$. Consequently, it may be said that in spite of the fact that the $\bar{\bar{X}}$ of the ten samples of five values agrees best with the true $\bar{X}' = 0$, all four $\bar{\bar{X}}$ values of the estimated process average are within the $\bar{X}' \pm 3\sigma_{\bar{\bar{x}}}$ variability expected due to chance causes of variation, characterizing the process having $\bar{X}' = 0$ and $\sigma' = 3.5$. As such, they, too, indicate a state of control in respect to the past standard.

Estimating the Unknown Standard from *m* Subgroups of *n* Values X (Fig. 2). The second phase of quality control technique, consisting of estimating the unknown standard will now be presented. It can be done readily by simply ignoring the knowledge of the previously established standard ($\bar{X}' = 0$ and $\sigma' = 3.5$) and by trying to estimate it from the evidence presented by the same four sets of n values, the averages and ranges of which are charted in Fig. 2 as 80 solid dots. How-

ever, before doing so, an explanation of the statistical basis of the tools used for this purpose may help to build faith in the acceptance of such tools.

It is to be noted that the evidence presented agrees very well with the statement previously made concerning the increase of the range as the sample size increases. In Fig. 2, this is illustrated by the progressively increasing magnitude of the four average ranges ($\bar{R}$) of the four sets of ten samples. It is also to be noted that there is a considerable clustering of these ranges about their average; thus, it may be surmised that, in the long run, the average range becomes a representative measure of variability of the n values. This is best confirmed by the close conformance of the values $\bar{R}$ and $\bar{R}'$ in the figure, in spite of the fact that ten samples hardly satisfies the condition "in the long run," for which a better expression would be, "in the long series of samples." But if $\bar{R}$ eventually becomes a constant and the σ', even if unknown, is always a constant as long as the process remains unchanged, the ratio between the two constants must be another constant, subject to statistical determination by extensive experimentation. In other words

(5) $\bar{R}/\sigma' = \text{constant} = d_2$

the magnitude of which increases as the sample size increases. From this relationship, it follows that if only $\bar{R}$ and d_2 of m subgroups of n values are known, the unknown σ' may be estimated as:

(6) $\sigma'_r = \bar{R}/d_2$

in which formula the sub-letter r stands for the abbreviation of the average range to indicate the method of estimation.

Consequently, the unknown $\bar{X}' \pm 3\sigma'$ may be estimated in this way:

(7) $\bar{\bar{X}} \pm 3\sigma'_r = \bar{\bar{X}} \pm 3\bar{R}/d_2$
$= \bar{\bar{X}} \pm (3/d_2)\ \bar{R} = \bar{\bar{X}} \pm I_2\bar{R}$

However, since the individual n values are usually not plotted, the derivation of the factors for the construction of the $\pm 3\sigma$ limits of variability for the averages of the n values which are plotted on the control chart are of interest. They are derived as follows:

(8) $\bar{X} \pm 3\sigma_{\bar{X}} = \bar{\bar{X}} \pm 3\sigma'_r/\sqrt{n}$
$= \bar{\bar{X}} \pm 3\bar{R}/d_2\ \sqrt{n}$
$= \bar{\bar{X}} \pm (3/d_2\ \sqrt{n})\ \bar{R}$
$= \bar{\bar{X}} \pm A_2\bar{R}$

In Fig. 2, such $\pm 3\sigma$ limits for averages based on the $\bar{R}$ values and the sample sizes are shown by the heavy dotted lines, so that the difference between them and the thin dotted lines represents the degree of departure between the $3\sigma_{\bar{X}}$ limits based on the true and estimated standards from the four sets of ten samples of n values.

A similar relationship as that just described between R and σ' obtains also between the $\bar{\sigma}$ and the σ' of the population, so that it may be expressed as follows:

(9) $\bar{\sigma}/\sigma' = \text{constant} = c_2$

Consequently, from the $\bar{\sigma}$ and the factor c_2 the unknown σ' may be estimated as:

(10) $\sigma'_s = \bar{\sigma}/c_2$

The subscript in this case indicates the method of derivation from the average standard deviation ($\bar{\sigma} = \Sigma\ \sigma/m$). Consequently, the estimated spread of the unknown $\bar{X}' \pm 3\sigma'$ may now be calculated as:

(11) $\bar{\bar{X}} \pm 3\sigma'_s = \bar{\bar{X}} \pm 3\bar{\sigma}/c_2$
$= \bar{\bar{X}} \pm (3/c_2)\ \bar{\sigma} = \bar{\bar{X}} \pm I_3\bar{\sigma}.$

Therefore, if standard deviations, instead of ranges, of samples of n values are charted for quality control purposes along with the control charts for averages, the control limits for such averages may now be calculated as follows:

(12) $\bar{\bar{X}} \pm 3\sigma_{\bar{X}} = \bar{\bar{X}} \pm 3\sigma'_s/\sqrt{n}$
$= \bar{\bar{X}} \pm 3\bar{\sigma}/c_2\ \sqrt{n} = \bar{\bar{X}} \pm A_1\bar{\sigma}$

(Although the control chart for standard deviation is not presented here, such charts have a definite place in quality control, especially if the process requires samples larger than 15 values. For, under those conditions range becomes an unreliable measure of variability for control purposes whereas the reliability of the standard deviations increases with the increase of the sample size.)

Control Chart for Ranges. Since the derivation of the $3\sigma_R$ limits is more complex, it is not presented. In Fig. 3, the $\bar{R} \pm 3\sigma_R$ based on the $\bar{R}$ values and the sample sizes are illustrated by the heavy dotted lines calculated as $D_4\bar{R}$ and $D_3\bar{R}$ which give directly the upper and the lower control limits for such ranges.

Test of State of Control in Respect to the Past Standard. The 3σ control chart limits extended into the body of the figure as thin lines are based on the established standard, $\bar{X}' = 0$ and $\sigma' = 3.5$ corresponding to the four sample sizes under consideration. Consequently, they are now used as a test whether the values on which the four sets of averages and ranges of the n values subsequently produced are based, conform to that past standard. Averages and ranges (full dots) outside those control limits are viewed as 99.73 percent evidence of a departure from that standard; all points ($\bar{X}$, R) within these limits (dotted thin lines) are viewed as 99.73 percent evidence of conformance to the past standard. Since all 40 values $\bar{X}$ and R are within these 3σ limits, conformance to the past standard, as well as a state of control, is clearly indicated. Under such circumstances, the grand average ($\bar{\bar{X}}$) and average range ($\bar{R}$) of such m subgroups of n values X may also be used for predictive purposes in the manner subsequently illustrated.

(Continued next month)

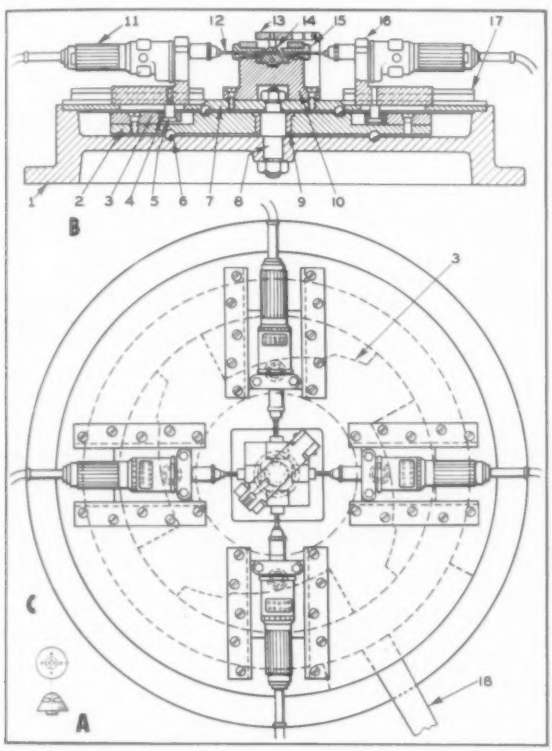
Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Four-Spindle Drill

The small brass piece shown at A in the sketch is a high production item and has four holes drilled in it. A four-spindle drilling machine would do the job, but the cost would be too high. Instead, four small portable power-driven drills were mounted on a table as shown. At B is shown a section through the drilling machines and drill jigs, while at C is a horizontal projection of the setup.

The holes in the workpiece are equally spaced at 90 degrees in a circle.



The four small drilling machines, 11, are held firmly in the sliding brackets, 16. These brackets have a sliding fit in the guide plates, 17. The shouldered screws, 5, in the brackets hold the hardened and ground steel rollers, 4. The guide plates and the drill jig are bolted to the round steel plate, 7, and the steel plate is screwed to the round cast iron table, 1. The round steel plate, 2, is pivoted on the bolt, 8.

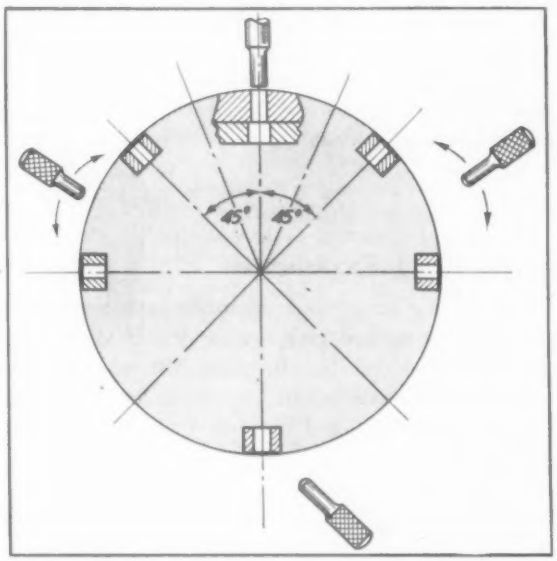
The four cams, 3, are bolted on the underside of the steel plate and rotate together with the plate when the handle, 18, is moved. In order to lessen the friction, steel balls are placed between the upper and lower plates. At 10 the drill jig is shown bolted to the plate. One of the four drill bushings is shown at 15, and 13 is a hinged cover for clamping the workpiece.

When the handle, 18, is turned to the left, all four drilling machines move toward the center and the holes are drilled simultaneously. Coil springs return the machines when the motion of the handle is reversed.

Hjalmar Dahl
Upplands Väsby, Sweden

Horn Die Indexing

The problem is to punch eight holes equally spaced radially around a drum, the diameter of which is about 13 in. with a variation up to $\frac{1}{8}$ in. The production was only 1,000, and the indexing method described here, while a little laborious, was both inexpensive and accurate. The hole location was expected to be within 0.003 in. of its true position.

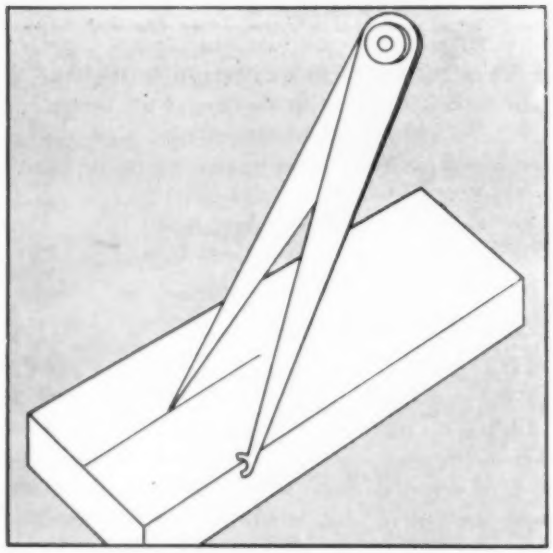


Three indexing pins are provided and the operator is instructed to index with two pins before operation, except for the first two holes. After the first hole is punched, the drum is rotated 180 degrees and the second hole is punched. The drum is then indexed 90 degrees at the two previously punched holes and the third hole is punched. Again the drum is rotated 45 degrees either way, indexing at two holes 90 degrees apart, and the next hole is punched. This same method of indexing can be used for punching holes when the number to be punched is a multiple of four.

K. C. Hu
Philadelphia, Pa.

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Hermaphrodite Calipers



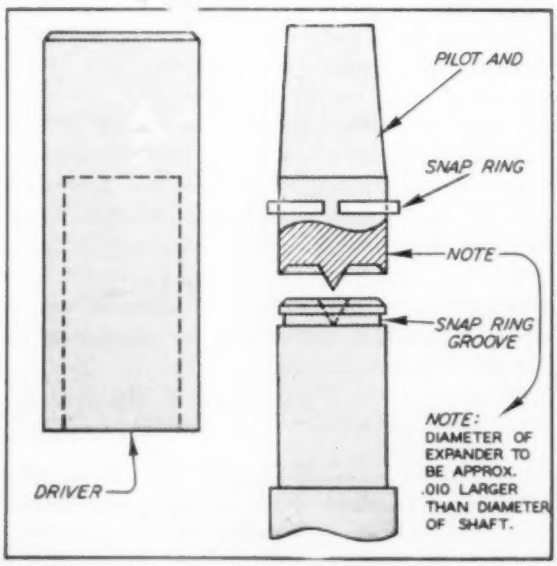
The hermaphrodite calipers shown in the accompanying sketch can be held on the edge of a workpiece with one hand and maintained in a steady position. The extra foot on the caliper leg makes this possible. By holding the tool at a 10 or 15-degree angle, it will ride the edge of thin material approximately 1/32 in.

J. A. Carothers
Pittsburgh, Pa.

Snap Ring Expander

Assembling snap rings on shafts is sometimes a time-consuming and exasperating job if tools have not been provided for the work. Shown here in this sketch is a device which makes the operation a very simple one and requires little skill on the part of the operator.

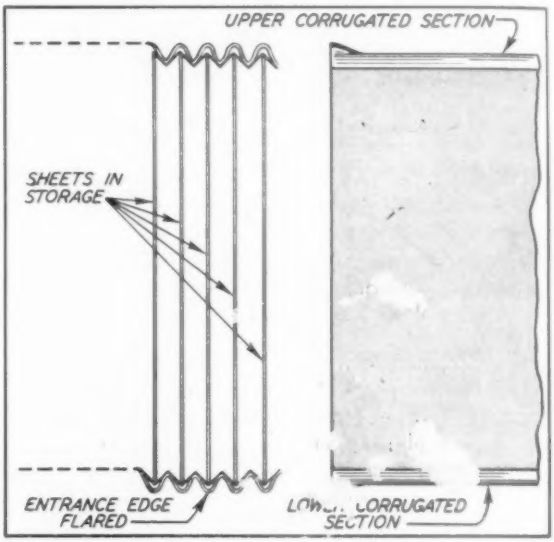
A pilot and expander is made about 0.010 in. larger than the diameter of the shaft onto which the rings are to be put. A driver as shown is then used to force the rings from the expander into the snap ring groove. It is suggested that the expander be loaded with snap rings, allowing enough space for the driver to start. It will then be necessary to add only one snap ring to replace the one that has been assembled to the shaft.



Martin Gauerke
East Gadsden, Ala.

Rack for Sheet Steel

The problem of how to store sheet steel for easy accessibility and protection was solved as shown in the sketch. The steel sheets, 8 in. x 11 in. x 0.036 in., were to be stored so that there was minimum contact with the rack and were not to touch each other. Spacing was to be such that any sheet might be removed.



The sheets touch the rack only at the edges and any sheet can be removed without disturbing the others.

Available surplus sheets of the same type were corrugated on a bench model brake. Lots of five sheets were then spot welded together to form continuous corrugated shelves. One edge of each sheet was flared before corrugating so that it became the entrance edge of the shelf to facilitate insertion of the sheet to be stored. Accumulated pitch errors on individual sheets were compensated for during welding.

A suitable rack structure was then built to accommodate these shelves and the complete unit mounted on casters for mobility.

Ernest J. Druan, Jr.
Cambridge, Mass.

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Progressive Dies

Tools for Mass Production

By Robert T. Kimmel

PROGRESSIVE DIES are used for work which must be cut from stock to the required shape and at the same time be provided with holes or perforations or with provisions for other operations to be performed successively. The principle of the progressive die such as would be used for piercing and blanking, is that while one part of the die punches the hole in the stock, another part blanks out the work at the face, while at a former stroke the station, a hole or opening was punched. Thus a completed article is produced at each stroke of the press. In reality, however, two separate operations have been performed, the operations being progressive in which the holes are first pierced after which the stock moves along until the pierced section is in line with the blanking punch. The simplest example of a die of this type is one used to produce washers. The pierce punch first cuts out the inside diameter of the washer. The blanking punch then completes the part in the second stage of the die.

Progressive dies are applicable where the amount of production of any given part will make it economically feasible to construct the elaborate and costly die. There is no doubt that the main governing factor in deciding whether or not the use of a progressive die is justified is the cost of the finished part. If the quantities of a part to be manufactured are large enough to justify the expenditure for the die, there will also result added simplification possible when using this type of manufacture. Automatic stock feeds and automatic parts handling of the finished product can be added at relatively small cost when volume is increased by using progressive dies.

Sectional Construction

Dies of this type are often designed as sectional tools, mainly for two reasons. Sometimes the shape of the part to be made is quite intricate, and a blanking die, a piercing, forming, drawing or other type of die, if made in a single piece, might present unusual difficulties in working out, particularly in respect to certain corners, recesses and angles. It may also be difficult to harden the die properly without danger of deformation in some important part. In some instances, the building up in sections permits the die to be disassembled, ground on worn faces to restore original size, and rebuilt without difficulty, whereas a one-piece die would be impossible to correct when worn beyond the permissible limits.

Larger dies, even of fairly simple form, are necessarily constructed in several sections. Even with medium-sized tools, the practice of using tool-steel working sections with machine-steel backing and carrying portions cuts down the cost of material and frequently simplifies the work of the die maker. Sometimes tool-steel members are secured to cast iron sections when a die is very large; also in many cases dies have been built with wood blocks faced with metal for doing some kinds of forming work.

However, it cannot be emphasized too strongly that when a great deal of money is to be spent in constructing an intricate progressive die, it is most unwise to use any but the best materials or to try any short cuts. Since the investment in time and money is so large, every care should be taken that the dies when completed, will remain in production and not have to be taken down for repairs.

Notching dies for electrical laminations and disks and other similar parts are frequently handled through the press by tools constructed on the built-up order where notched openings are more easily cut from the exterior of the die center than they could be with a solid form all the way around the notched location.

By far the most common applications of progressive dies are for producing laminations for electrical equipment such as rotor and stator punchings. These are the classic examples of the application of the pro-

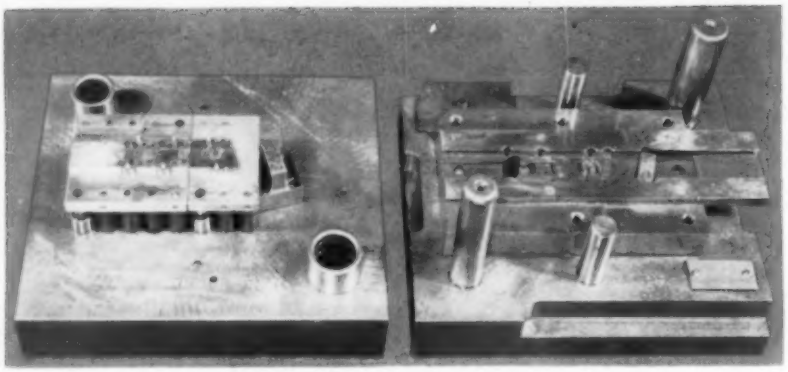


Fig. 1 shows the nine-station progressive die which produces the part shown in Fig. 2 (right). This is a small off-set bracket which can be produced at the rate of 10,000 pieces per hour. A tolerance of 0.002 in. is maintained in the depth of the offset.

gressive die principle for the production of stampings in quantity. However, there are many other forms and shapes which may be produced economically in this manner. The stock handled ranges from sheet only a few thousands of an inch thick up to heavy pieces of cast iron, brass and aluminum.

The part shown in Fig. 2 is produced in the progressive die shown in Fig. 1. This is a nine-station die for making the small offset bracket. In Fig. 3 is shown the strip of stock from which the part is punched, and Fig. 4 shows the operations chart for the process. With this setup, the manufacturer can produce more than 10,000 pieces per hour. A tolerance of 0.002 in. is maintained on the depth of the offset and 0.005 in. is held on the depth of the two embossings. It can be seen by looking at the piece part scrap frame that two brackets are made simultaneously, one on each side of the stock strip.

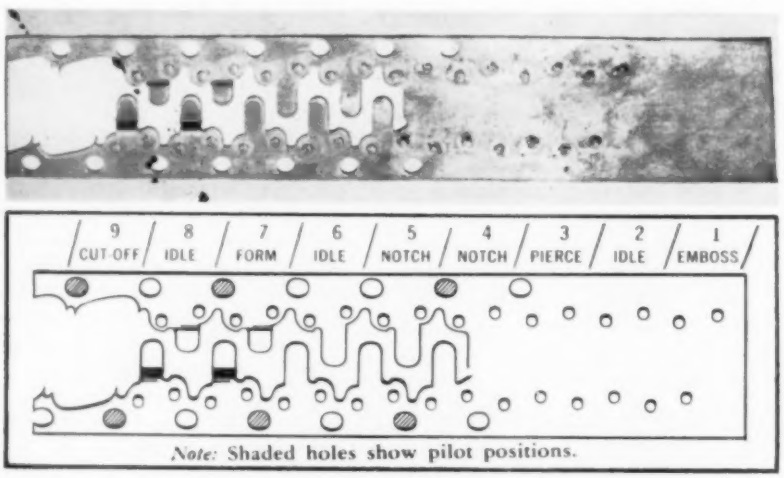
In Figs. 5 and 6 are shown the dies and piece part strip used in the production of a nut chopper. This is a ten-station progressive die which operates as follows: (1) pierce and notch; (2) pilot; (3) notch left edge; (4) rough form center; (5) finish form center; (6) idle; (7) twist; (8) idle; (9) idle; (10) cut off. The thickness of the stock is 0.042 in. Maximum production for the part is 7200 pieces per hour.

Recently a large die manufacturer was asked to construct a progressive die to produce a shield base stamping for an electrical manufacturer. The part was being made in an automatic operation only to a certain point, and was then finished in single-station dies; this process required from three to six presses, depending upon the particular type of base, and the limited number of parts available. Additional time and equipment were also needed to handle material between machines. After the design and production engineers had studied the shield base to determine whether or not it could be manufactured in a one-press setup, the decision was reached that this method of manufacture would greatly increase production, cut costs and eliminate all hand-fed operations with material handling between machines.

By developing a strip layout, the tool engineers saw that a minor modification could be made in the part which, without affecting its functional value, would simplify die construction and maintenance. The recommended changes were approved. A 16-station progressive die was designed, built and installed in a new double-crank press with feed and take-up reel for scrap.

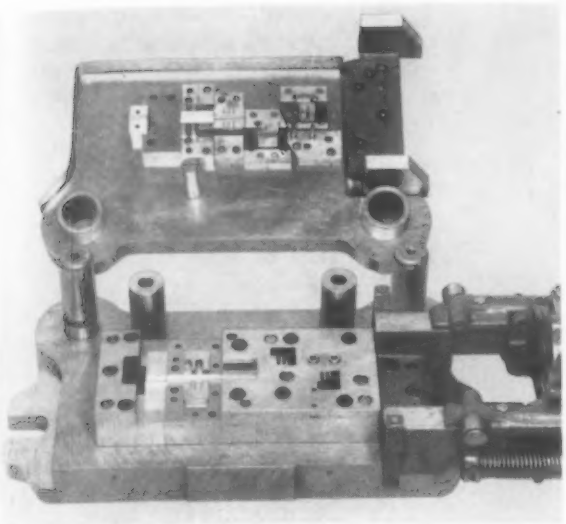
A close-up of the die, built by Volkert Metal Stampings, is shown in Fig. 7 in which the various stages of the die can be seen. Fig. 8 shows the die installed in the press. In stamping out the shield bases, the stampings are trimmed, drawn, blanked, straightened, pierced, necked, formed and dimpled. The sectional construction of the die facilitates maintenance.

The 13-station progressive die shown in Fig. 9 has interchangeable sections to produce various



Note: Shaded holes show pilot positions.

Fig. 3 shows the progress of the strip through the die, while in Fig. 4 is shown the operation chart.



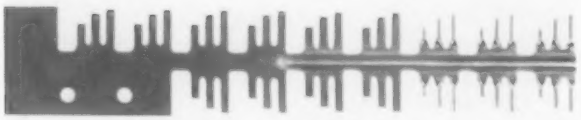


Fig. 5. The ten-station progressive die shown here produces a nut chopper. The piece part strip is shown in Fig. 6. The die pierces and notches at the first station, pilot, notches left edge, rough forms center, finish forms center, idles, twists, idles, idles, and cuts off. The thickness of the stock is 0.042 in.

types of covers for volume controls. Another seven-stage die is shown in Fig. 10 which forms two matching half shells from stainless steel with each stroke of the press.

Fig. 11 shows a ten-station progressive die which produces two miniature socket contacts from such materials as brass, phosphor bronze or beryllium copper. The die in Fig. 12 is a carbide die which trims, draws and blanks stainless steel parts for expansion bracelets. The high production die in Fig. 13 is equipped with carbide inserts and produces tulip-shaped end caps for ceramic condensers.

Check List for Progressive Dies

Probably one of the most comprehensive lists of procedures and checks for use in designing and manufacturing progressive dies was compiled a few years ago by J. R. Pacquin. Including 58 steps, the compiler states that if the order given here is followed, the die will be laid out in the proper sequence, and if none of the checks has been omitted, no part of the finished die will be missing. The importance of the proper sequence in making design decisions deserves special emphasis, since an operation performed at a stage where it is not most advantageous can reduce appreciably the benefits to be derived from progressive dies. The check list follows:

1. Develop the blank with dimensions in decimals.

2. Establish a tentative sequence of operations, allowing idle stations for adequate strength of sections. Consider the required part accuracy. Progressive dies cannot hold distance between holes and outside of blank closer than 0.005 to 0.010 in., depending on the size of the blank.

3. When piercing stock 'in the flat' (which is to be bent later), the edge of the hole must be at least 1½ times the stock thickness from the centerline of the bending radius.

4. Can frail inserts be eliminated by punching out certain portions of the blank at one station, and blanking the rest in a later operation?

5. Lay out the scrap strip, using three cardboard templates. Consider:

(a) Relation of bend to grain. It must not be less than 30 degrees across the grain.

(b) Relation of burr side to bend. Burr must always be on the inside.

(c) Pilot interference.

(d) Half holes.

(e) Partial blanks.

(f) Location of pilot holes. Pierce these at the first station.

(g) Material economy.

6. Establish the final sequence of operations.

7. Establish the blanking centers and the strip width.

8. Mark, in color, the bolster plate opening for scrap disposal to insure that scrap holes in the die are over this opening.

9. Establish the location of the punches for the pilot holes at the first station. On drawn work, drawing takes precedence and is done at the first station. Drawing depth must not exceed 3/16 in., with the diameter of the cup twice the depth, or more.

10. Pilot in the pierced holes at the second station. Decide the succeeding pilot sequence.

11. Draw the notching punches. Incorporate back-up heels. These are usually placed at the first or second station, or both.

12. Decide the method of bending. Two procedures are: (a) bend the ears down; (b) ramp the strip and form the ears up. At the last station, when cutting off and bending simultaneously with a pressure pad, the difference in height between the cut-off punch and the bending punch must be one stock thickness. Provide a pressure pin in the bending punch to hold the stock while cutting takes place.

13. Design any forming punches. Forming is performed, usually, immediately before or after cutting off (for one form). Provide shedder pins as required.

14. Design the spanking punch if one is necessary. It is usually placed at the station preceding the last operation, for one spank. Combine

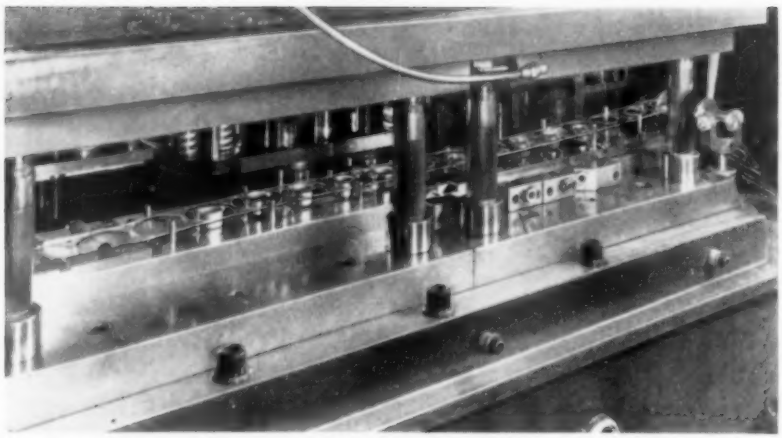


Fig. 7. Shown here is a close-up of a sixteen station progressive die for producing a shield base for electronic tubes.

with the bending or forming operation, if possible.

15. Decide if a scrap cutter is necessary, and where it is to be applied.

16. Sketch a suitable method of strip location:

(a) Channel stripper.

(b) Channel and bar pusher.

(c) Channel and roller locator.

(d) Equalizing bars and rollers.

The length of the actual guide before the first operation should be at least twice the stock width.

17. Sketch the die block. The minimum distance between the die-hole edges and the outside edge of the block should be from one to one-and-one-half times the thickness of the block, or more, depending on the intricacy of the block opening. Establish the number of sections for easy machining, hardening and replacement. Decide the method of keying and whether the key should be set into the die holder or set on top. Select the screws (and dowels, if the die is to be set on top). If it is possible to assemble the die parts improperly, show one dowel off center for foolproof purposes.

18. Locate the finger stops.

Fig. 8. The sixteen-station progressive die for producing shield base stampings is shown here mounted in a press.

19. Choose the automatic stop.

20. Incorporate inserts at weak places, if any are required.

21. Select a die set from the manufacturer's catalog. Use one longer than necessary to provide for possible future additions. Allow $\frac{5}{8}$ in. minimum between the die posts and die block for grinding clearance. Use a semi-steel die set for average work. In severe applications, specify an all-steel die set.

22. Decide the grinding allowance, normally $\frac{1}{4}$ in.

23. Consider how sharpening will affect relative heights of bend and form punches. Spacer pieces may be required.

24. Compute the spring sizes and list on the drawing.

25. Where a bent lug on the part would be injured by crowding, provide a punch long enough to push the blank through the die. However, this type of punch construction should be avoided if at all possible.

26. Must punches be contained in a quill? If possible, mount all quills in individual punch plates.

27. All delicate punches must be guided in the stripper. If they come too close together, apply a tool steel block.

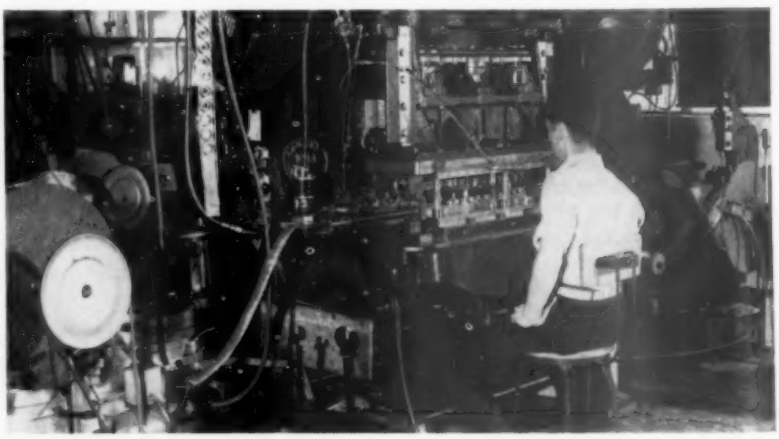
28. Slender piercing punches, set close to a large punch, should be made shorter by the material thickness plus 0.010 in., at least. This practice avoids deflection by metal crowding to one side. Step small punches set close together. Punches used to perforate shaker tops, colanders, etc., would fall in this classification.

29. For a small punch producing a hole 30 to 35 percent deeper than its own diameter, the shank should be at least twice the hole diameter. The cutting end should be hole-size for only two stock thicknesses.

30. For angular-headed punches made of drill rod, use a 60-degree included angle. This type of punch may be used only when the diameter of the hole to be pierced is at least twice the stock thickness. It should always be guided in the stripper.

31. Punches should not be any longer than three or four inches overall. Use auxiliary plates if necessary.

32. All punches used in high-grade dies should be guided in the stripper. For low-production requirements, they need not be guided if the point diameter exceeds twice the material thickness.



33. For punches too small in diameter for push-off pins, but with a hole diameter from two to three times the material thickness, rounding the punch face will prevent slugs from pulling up. If smaller, make the die hole wall straight for twice the material thickness, at least, and reduce the clearance between the punch and die.

34. The flange width of unguided blanking punches should not be less than the punch height.

35. In larger piercing punches, provide holes for push-off pins to prevent slugs from pulling up.

36. Never press a hardened punch into a hardened punch plate. Use a soft plug in applications of this nature.

37. In detailing, make the punch body a light press fit in the punch plate. It should be a slip fit except where it actually bears in the punch plate.

38. Where other-than-round punches are needed, lock the punch by a milled flat in the punch head.

39. Long slotting punches should be made low in the center so that the ends will cut first. Leave the face flat for $\frac{1}{8}$ in. at either end.

40. Blanking punches with pilots must be set ahead of the piercing punches so that the pilot can locate the strip before piercing punches bind it. A height difference of 0.010 in. should be allowed.

41. When 'shearing' punches and dies, the distance between high and low points should be from two-thirds to one thickness of stock. For piercing dies, apply shear to the punch. For blanking dies, (where the blank is saved), apply it to the die.

42. Taper ream scrap holes $\frac{1}{4}$ degree on a side, or $\frac{1}{2}$ degree included angle, leaving straight the first $\frac{1}{8}$ in. from the cutting edge.

43. In piercing, when using tool steel bushings set into the die block, make all holes in the block, stripper and punch plate the same size if possible, so that they can be bored together.

44. When pressing die buttons into a hardened block, use a light press fit and 'shoulder' them to prevent pulling out.

45. Use a hardened plate in back of all punches, where necessary. This applies to dies for long runs and also for all small punch heads. Make these backing plates $\frac{1}{4}$ in. thick. On a semi-steel punch holder, use them for No. 11 gage material and over. For steel punch holders, use them for No. 7 gage material or over. Always use them for very small punch heads, however. Round plates, counter bored into the punch holder, will serve for single punches. Square plates, cut 'to suit,' can be used for multiple punches.

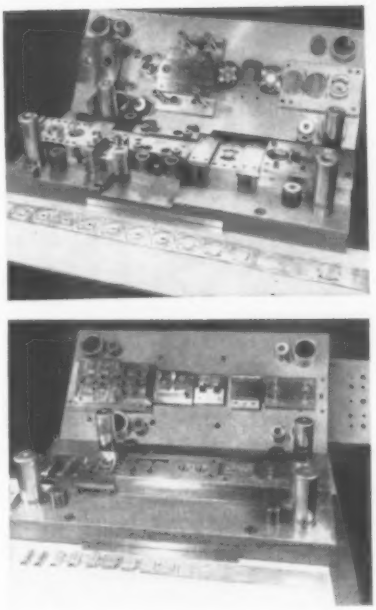


Fig. 9 (above): This progressive die has interchangeable sections for producing various types of covers for volume controls. Fig. 10 (below) shows a die which forms two matching half shells from stainless steel.

46. If possible, the pilots should be made removable for ease in grinding punches.

47. Avoid spring pilots, if possible. However, they must be used for stock heavier than 1/16 in. thick.

48. Carry the pilot holes through the die and die holder, and taper ream them $\frac{1}{4}$ degree per side to compensate for mis-feeds. This is equivalent to $\frac{1}{2}$ degree included angle.

49. Compute the required stripper plate thickness.

50. Make the channel stripper width (inside) a minimum of 0.004 in. greater than the strip width.

51. The punch plate thickness should not be less than $1\frac{1}{2}$ times the diameter of the punch shank. The material should be tool steel, left soft, or good machine steel.

52. Punch plates and die plates must be from $1\frac{1}{4}$ to $1\frac{1}{2}$ times wider than they are high, minimum, for stability.

53. Decide the location of any air vent holes.

54. Bolt heads in die plates should be set $\frac{1}{4}$ to $\frac{3}{8}$ in. below the top surface to allow for sharpening the die.

55. Tapped holes for fastening gages should be tapped $\frac{1}{4}$ to $\frac{3}{8}$ in. deeper than necessary to allow for sharpening the die. This lowers the gages.

56. Incorporate bumper blocks if required.

57. In the bill of materials, specify the steel for cutting members so that they can be machined with the cutting edges at the end of the grain.

58. Furnish a jig-boring layout, set to the correct blank angle, and incorporating the proper clearance.

In Fig. 15 is shown the piece part produced by the punch and die shown in Fig. 14. Fig. 16 shows some of the sections through the die. By comparing these detail drawings with the list given above, it is possible to see how these many features and items were incorporated in the finished die.

Preventing Punch and Die Failure

If each of the steps in the foregoing check list has been followed, there is little likelihood of failure on the part of either the punch or the die. However, for easy reference, there is included here a list of the most likely points of failure keyed to a drawing compiled by the Moore Special Tool Co., from a year-to-year record kept of such failures.

1. Spring life. Spring failure is common but when springs of ample length and strength are used, little trouble is encountered. The average

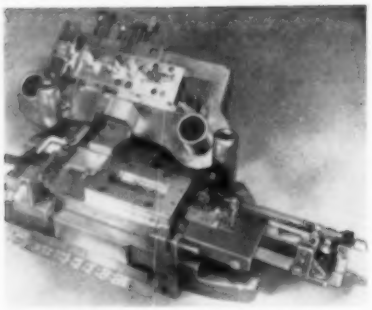


Fig. 11. This is a ten-station progressive die which produces two miniature socket contacts from such materials as brass, phosphor bronze and beryllium copper.

spring can be compressed 25 percent of its free length safely.

2. Removable pilots. If possible, pilots should be removable as shown to facilitate grinding.

3. Provision for grinding. These spacer pieces provide a means of keeping the relative length between these two punches and the rest of the punches after sharpening the tools. The designer must keep this point constantly in mind.

4. Thickness of punch plate. The punch plate must be of ample thickness, particularly when punches are not guided in the stripper. Punches of $\frac{1}{2}$ in. in diameter cannot be supported properly in a plate less than $\frac{3}{4}$ in. thick.

5. Punch shank location. For radial location, a dowel through the head of a punch is more positive than the 'dutchman' which goes half into the shank and half into the plate.

6. Material in punch plate. By selecting the best grade of tool steel for the punch plate, time will be saved in the jig borer and more accurate holes will result.

7. Guiding delicate piercing punches. A delicate punch such as this must be guided as near as possible to the work. This can be done by a plate set in the bottom of the stripper, (27), or with a bushing as shown. Grinding life is sacrificed to produce a punch that will not break in use.

8. Spring pilots. Occasionally it is necessary to put springs behind pilots for various reasons.

9. Piercing small holes in thick stock. A piercing punch held in a thick punch plate backed up as shown and guided in stripper bushings will punch holes in material 30 to 35 percent thicker than its own diameter. The shank, however, should be at least twice the diameter of the hole being punched, and the cutting end must be the hole size for only about two thicknesses of the material. Here punch life is sacrificed to gain strength.

10. Angle on headed punches. About a 60-degree included angle seems to give the best results.

11. Hardened plate under the punch plate. This construction is often advisable to keep small punch heads from pounding into the punch holder, which will eventually fracture the head, causing the punch to pull out.

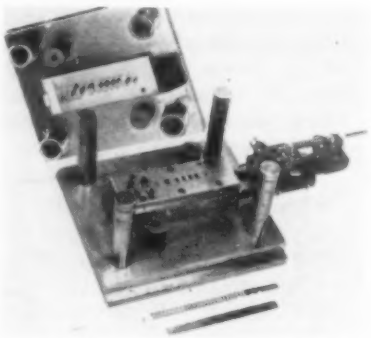


Fig. 12. This is a carbide die which trims, draws and blanks stainless steel for expansion bracelets.

12. Holding punches. This method of holding punches eliminates the necessity of driving hard and is desirable in some cases.

13. Sturdy unguided piercing punches. It is advisable to guide piercing punches in the stripper, but when it cannot be done, sturdy punches such as these will produce good results.

14. Grinding punch shanks. All punch shanks should be ground to the proper drive or tap fit. Drive fits tight enough to keep the punch from pulling out should be avoided. Punches with heads (or screws, see

Figs. 14, 15, and 16 at the right show the piece part and die used to develop the part. At the top is shown a plan view of the punch and die. Inserted is a view of the part produced. The lower part of the page shows sections through the die.

12) need only be a snug fit in the hole.

15. Die set bushings and posts. The designer should give some thought to the requirements of the particular die in question. On precision jobs when cutting thin stock, extra long bushings aid in lining up. Four-post sets are often advisable.

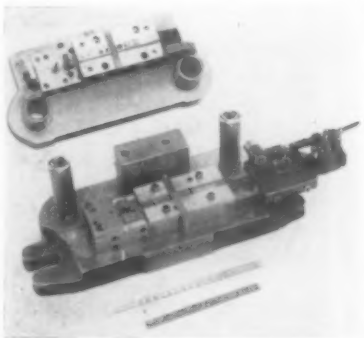
16. Die thickness. The requirements of the individual die must be studied in order to establish the correct thickness.

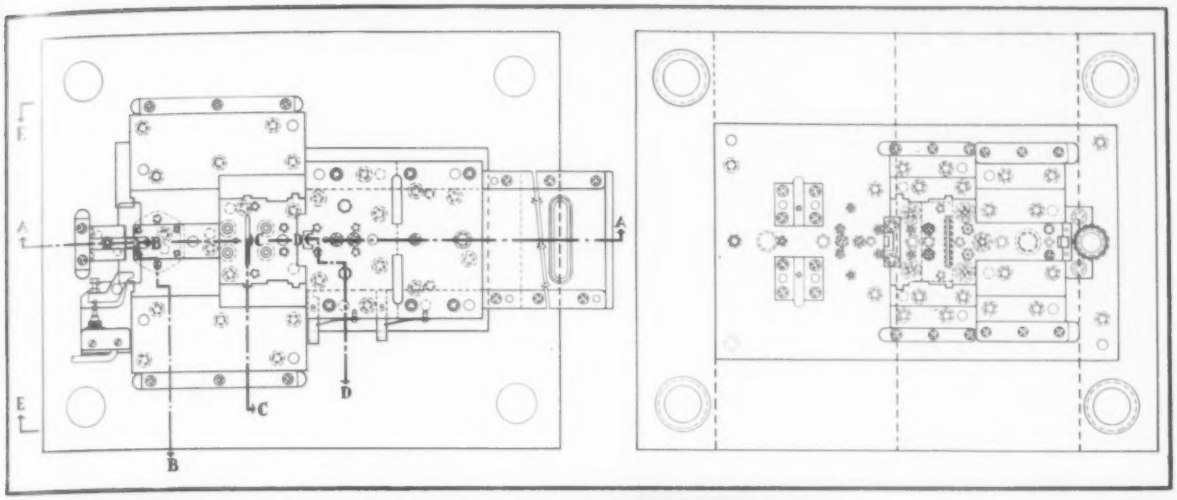
17. Inserts for weak places. All delicate projections on a die should be inserted for economical replacement in case of breakage.

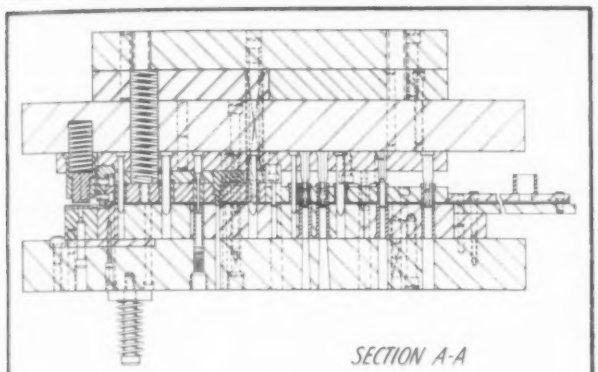
18. Punch life or length. Making short punches is one way of cutting the cost of dies. Dies made for long production runs should have punches long enough to allow from $\frac{1}{2}$ to $\frac{5}{8}$ in. of grinding stock at the piercing end. Delicate punches, however, must be made short to give maximum strength.

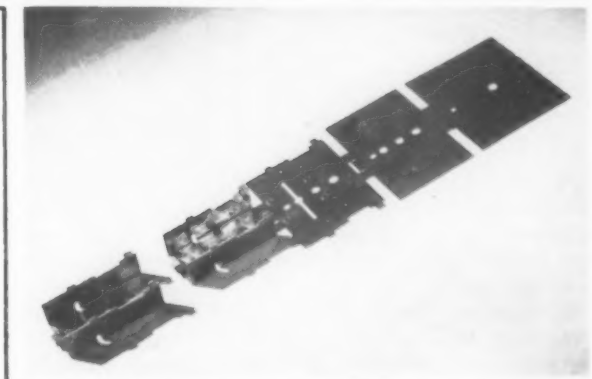
19. Holes for spring push-off pins. Before hardening of blanking punches, it is well to drill a hole in which can be inserted a spring pin in case the blank pulls up.

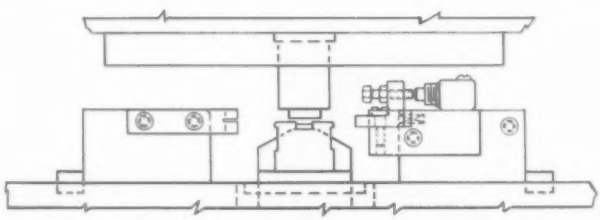
Fig. 13. This high-production die is equipped with carbide inserts and produces tulip-shaped end caps for ceramic condensers.

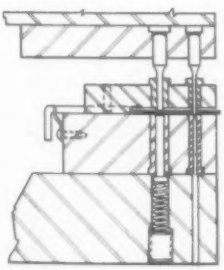


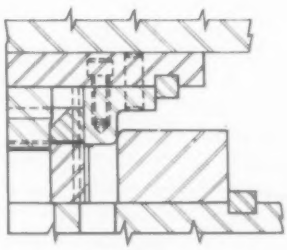

F
A
E
B
C
D
A

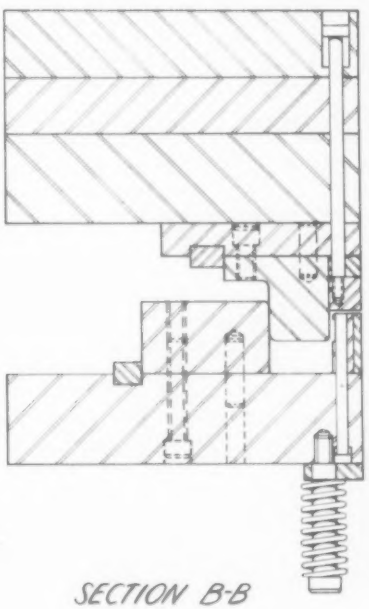

SECTION A-A




SECTION E-E


SECTION D-D


SECTION C-C


SECTION B-B

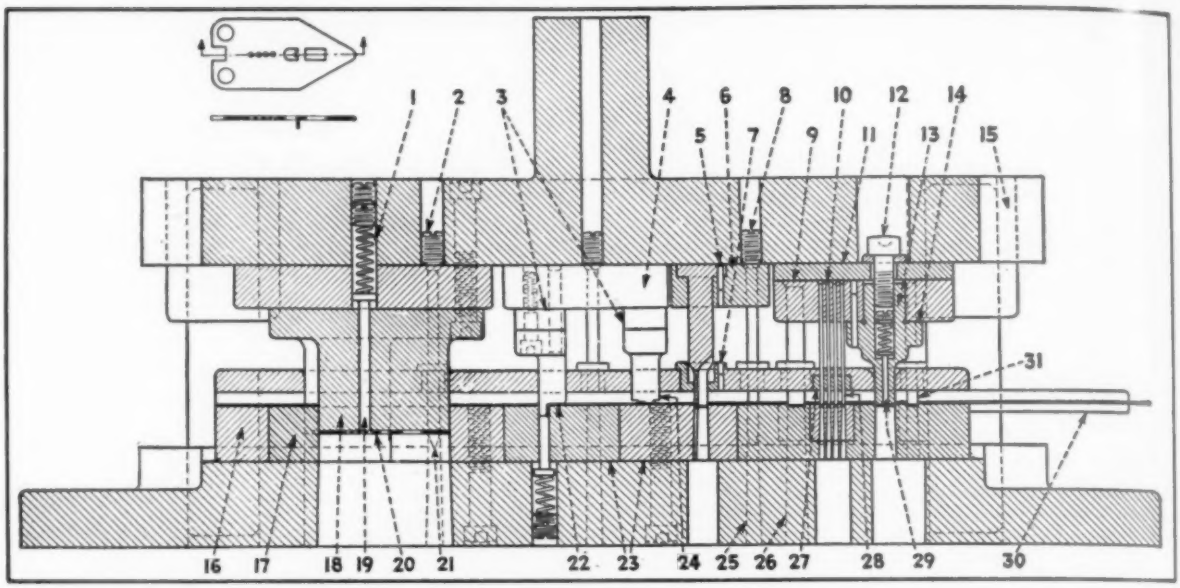


Fig. 17. The numbers here refer to the check list given in the text under preventing punch and die failure. (Figure courtesy of *Moore Special Tool Co.*).

20. Must each blank be pushed through? Where a blank has a bent lug such as is shown, the designer must provide a long punch to push each part clear.

21. Piloting. The success of a progressive die depends largely on pilots. Special holes for pilots in the scrap are advisable in most cases, even though the cost is increased.

22. Bending against the grain. This is a costly error to make.

23. Has the die sufficient sections? A separate section for each station is a safe rule to follow when designing progressive dies. Sometimes, however, even more are required.

24. Bumper blocks. If the die is accidentally closed too far with no stock in place, stamps and short punches will be damaged. To avoid this, screw one or two short blocks in the rear of the die just high enough to fill the space between the die shoe and the punch holder. This will also ease the task of setting up the tool.

25. Scrap holes for pilots. Due to occasional mis-feeds, pilots will push scrap into pilot holes. Therefore, these holes should be carried through and taper-reamed as shown to allow the passage of the scrap.

26. Scrap holes in die bed. Slugs often stack, catch or wedge. Cast iron die beds may have small blowholes which will afford places for the scrap to catch. Holes should be smoothly taper-reamed with no steps or pit holes so that slugs will not catch. Steel bushings can be inserted if a blowhole exists.

27. Punches closely spaced. Where space does not permit bushings in the stripper, an insert such as shown should be provided. If precision spacing is required, the location of holes must be corrected after hardening by grinding.

28. Wire punches. This type of punch made from drill rod with upset head will stand up provided it is piercing holes whose diameter is twice stock thickness. They should always be guided by stripper bushings.

29. Spring push-off pins in piercing punches. As with the blanking punches, it is advisable to provide a hole to insert a stripping pin in case the slugs tend to pull up.

30. Stock guides. Stock guides should be provided to guide the stock a distance which is at least twice the width before the first operation. A variety of devices can be installed.

31. Keeping small piercing slugs from pulling up. This concerns punches too small for spring pins. Particularly when piercing hard stock, slugs will have a tendency to pull up, hindering the feeding of the strip. If the hole diameter is two or three times the stock thickness, this can usually be stopped by pointing the punch slightly.

References

"Fifty-eight Pointers for Design of Successful Progressive Dies," by J. R. Pacquin, *American Machinist*, Sept. 22, 1949.

"Modern Industrial Die Design," by Edmund A. Nowolinski.

"Handbook on Designing for Quantity Production," by Herbert Chase.

"Die Design and Diemaking Practice," edited by Franklin D. Jones.

"Pressworking of Metals," by C. W. Hinman.

Photographic Credits

John Volkert Metal Stampings, Inc.

Danly Machine Specialties, Inc.

White-Rodgers Electric Co.

Cover

The six-stage progressive die shown on the cover is used by the Detroit Stamping Co. to produce brake shoe retainers for an automobile manufacturer.

Buffalo Set for Area Meeting Oct. 10-11

By Nancy L. Morgan

Buffalo, in the heart of the world-famous Niagara region and the gateway to Canada, will be host October 10 and 11 to ASTE members from the northeastern United States and Canada for an International Area Meeting and the Semi-Annual Membership Meeting.

National officers and directors of the Society and members from 13 participating chapters—Buffalo-Niagara Frontier, Rochester, Erie, Syracuse, Mohawk Valley, Elmira, Toronto, Peterboro, Hamilton District, London-St. Thomas, Niagara District and Grand River Valley—will gather in one of the country's leading industrial centers for an outstanding program of plant tours, technical sessions, ASTE meetings and a banquet. A well-organized schedule for ladies' activities is also planned for the two-day event.

500 Members Expected

The entire program in Buffalo has been designed to make the International Area Meeting and the Membership Meeting a memorable success for the expected attendance of 500 members.

Headquarters for the meetings and banquet will be located at the Statler Hotel. Here the board of directors will hold its semi-annual meeting, members will gather to discuss chapter and national programs, top-flight technical speakers will address ASTE audiences on pertinent subjects and all those attending the area meeting will enjoy the entertainment and sociability of the Society banquet.

Advance registration is particularly encouraged because of the large number of people which will be accommodated both for housing and for the banquet. Forms will be sent by mail and prompt return of registrations will insure the desired arrangements.

The Ford Motor Company's new plant in Buffalo will be open to ASTE, in what may be the very first organizational tour through the plant, for visitation Friday morning and afternoon. Society visitors will be taken through the Chevrolet and Worthington Corp. plants in other Friday tours.

The first technical session will be addressed by R. A. Freeman, chief engineer for The V & O Press Co. He will speak Friday morning on "Factors Affecting Punch Press Capacity."

Three technical speakers will present programs Saturday morning. M. F. Judkins, chief engineers, High Temperature Alloys Div., Firth-Sterling Steel & Carbide Corp. His topic will be "Electro-Mechanical Machining of Hard Materials."

"Mold and Die Hobbing" will be discussed by A. J. Bachner, president, Midland Die & Engraving Co. B. R. Walsh, Gulf Research & Development Co., will address a technical session on "Hi-Jet Lubrication."

Banquet on Friday

Departing from usual procedure, the banquet committee selected Friday evening for the Society banquet at which a speaker of national interest will address an audience of ASTE members and their wives. An excellent dinner and outstanding entertainment are also scheduled.

Ladies will have opportunity to visit Niagara Falls, have luncheon in the Rainbow Room of the General Brock Hotel overlooking the Falls, attend a fashion show and participate in a local television show.

(Continued on next page)

An aerial view of Niagara Falls shows only part of the splendor of one of America's most famous scenic areas. The official program of ladies' activities at the International Area Meeting included a visit to the Falls and luncheon in the Rainbow Room of the General Brock Hotel.

(Continued from page 77)

Host chairman for the area meeting is Wilbur Reich, William Clarke is general chairman. Social programs are under the direction of W. J. Iekel. The banquet is being handled by J. A. Moneypenny, entertainment by G. C. Kingston and ladies' activities by Russ Fitclo. P. C. Richardson is in charge of reception.

Chairman of technical activities is E. A. Slate. Paul Knopp is organizing plant tours and O. V. Guenther is technical sessions chairman.

H. W. Ellis is heading supplementary activities. Transportation chairman is C. S. Oliver, signs are being handled by G. L. Rathman, sessions arrangements by E. D. Csont.

Housing chairman is J. R. Fisgus, registrations chairman is Glenn Carrol and tickets chairman is Art Thermalen. V. F. Villella is handling publicity, R. S. Slate is in charge of budgets, E. J. Boggan is in charge of records and reports and Don Reep is head of the emergency committee.

Officers to Attend London Tool Exposition

Tool shows in Hannover, Germany, and London, England, are among the major attractions for two ASTE officers making trips to Europe.

Joseph P. Crosby, second vice president, will leave New York on the Queen Elizabeth on September 3 to attend the International Machine Tool Exposition in London as official delegate representing the Society. During the show, he will be a guest of both the Machine Tool Trades Association and the Institute of Production Engineers, Great Britain's counterpart of ASTE. Mr. Crosby will also attend the Hanover Machine Tool Show to be held September 19 and 20.

F. J. Schmitt, director-elect, left August 22 for a six-week tour of Sweden, Belgium, France, Germany, Switzerland, Italy and England. The exposition in London is also included on his itinerary.

Reports on the observations made in Europe by Mr. Crosby and Mr. Schmitt will be published in an early issue of THE TOOL ENGINEER.

Canadian Scholarship Winner Announced

The Canadian winner of the Society's annual scholarship has been announced by A. R. Diamond, chairman of the national education committee. The award will go to William Roy Hammond of 42 Glebeholme Blvd., Toronto, Ontario, a senior in Mechanical Engineering at the University of Toronto.

William Hammond, Canadian winner of a national ASTE scholarship has worked summers to earn a large portion of college expenses.

The scholarship of $300 is judged on the basis of scholastic standing, recommendations by faculty members, and the interest shown by the student in tool engineering. Four other awards were given to United States students last July.

Mr. Hammond expects to work in the field of tool and production engineering after his graduation next June.

Plan Distribution of ASTE Lecture Material

Another national service of ASTE will be made available to chapters this fall when a lecture on "The Forces in Single-Point-Tool Metal Cutting," complete with slides, will be ready for distribution.

Prepared by Frank Wilson, Society technical director, and sponsored by the national program committee, the 40-minute lecture is designed to be read by the program chairman or another chapter member during a regular ASTE technical session. The manuscript and the slides for the program will be furnished free of charge to ASTE chapter and student discussion groups.

Reception of this initial lecture will determine the circulation of other programs on tool engineering topics.

ASTE Participates in Engineering Centennial

ASTE is one of more than 60 engineering societies participating in what may be the largest gathering of engineers in history—the Centennial of Engineering to be held September 3-13 in Chicago. More than 30,000 engineers are expected from all over the United States, supplemented by delegations from Canada, Latin America, Australia, North Africa, and Far East and practically all European nations on this side of the Iron Curtain.

The lists of speakers who will be heard on the various programs read like a "Who's Who" of American science, industry and education. Included are the chairmen, presidents or ranking officers of scores of America's largest business enterprises.

The Society will be represented by President L. B. Bellamy who will deliver an address on tool engineering at a session scheduled September 5 at the Eighth Street Theater. Vice chairman at the meeting will be Past President H. L. Tigges, executive vice president of Baker Bros., Inc.

Governor Adlai E. Stevenson of Illinois has issued a proclamation urging public participation in the Centennial and requesting the people of Chicago and Illinois to do their part in making the occasion a memorable success.

Adams Named Head of Metal Working Division

Ogden R. Adams, Jr., has been appointed head of the Metalworking Equipment Division of the National Production Authority. He succeeds Past President J. J. Demuth in the post.

A member of the Rochester ASTE chapter, Mr. Adams has served the past 15 months as a specialist in the division he now directs.

Piedmont Chapter Host to ASTE Officers

North Carolina Members Plan Sept. 26-27 Program: Executives' Night, Plant Tours and Membership Meeting

A lively pace and a jammed calender are in store for ASTE's national officers September 26 and 27 when they meet for a series of plant tours, an Executives' Night, and meetings with the Piedmont chapter in North Carolina. Activities during the two days will center in Winston-Salem, Greensboro, and Burlington.

National representatives of the Society who will be present for the Piedmont program are: President L. B. Bellamy, First Vice President Roger F. Waindle, Third Vice President H. B. Osborn, Jr., Secretary H. E. Collins, Treasurer H. C. McMillen and Assistant Secretary-Treasurer G. A. Rogers.

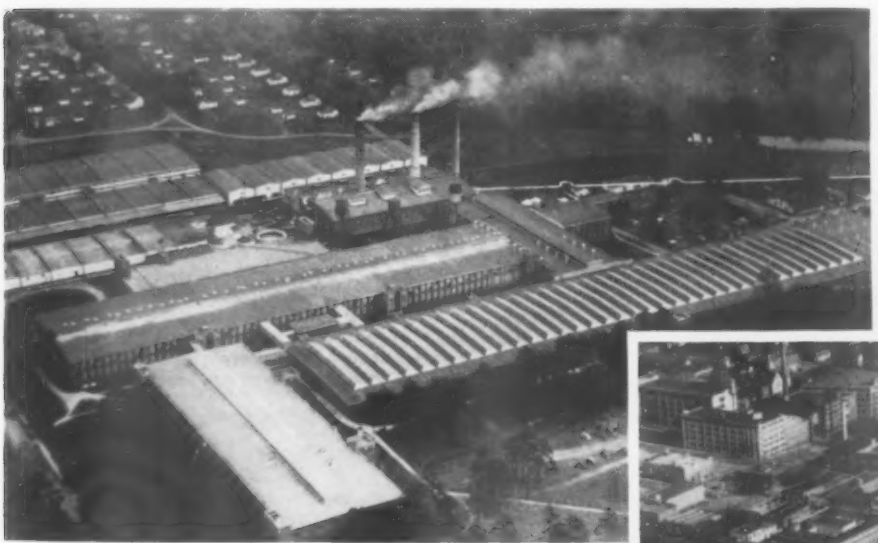
Joseph P. Crosby, second vice president, will not be able to attend since he will be in London, England, for the International Machine Tool Show.

The extensive program planned by Piedmont members will be opened Friday with four plant tours. Manufacture of radar and guided missile equipment will be viewed at the Western Electric plant in Burlington. This tour will be followed by a visit to a tobacco auction. The R. J. Reynolds' tobacco plant in Winston-Salem will be toured by the national officers who will later visit the Hanes Knitting Mills and the White Oak plant of the Cone Mills Corp.

An Executives' Night program is planned for Friday evening. In addition to chapter members and the visiting officers, the guest list will include executives of many of the large North Carolina manufacturing firms and their representatives, engineering directors from North Carolina State College and Duke University, the director of the Department of Conservation and Development of North Carolina, directors of the National Association of Manufacturers residing in the area, men heading the various chambers of commerce located in the area, and school system officials.

All of Saturday wil be devoted to meetings with officers, committees and members of the Piedmont chapter to discuss local plans and national progress of the Society. An informal supper is planned for the evening.

Right: The famed tobacco auctions will be seen first-hand by ASTE officials on their visit to North Carolina.



Above: The White Oak plant of the Cone Mills Corp. is on the list of tours planned for Society officers visiting the Piedmont chapter. They will also visit the Hanes Knitting Mills, the R. J. Reynolds Tobacco Co. and the Western Electric plant in Burlington. Right: The downtown area of Winston-Salem is shown in this aerial view of the city.

Future education programs of the Society were planned at a recent meeting of ASTE's national education committee at the Hotel Statler in Detroit. Checking scholarships offered by many of the chapters are, from left: Prof. Frederick Preator, Salt Lake City; Prof. M. L. Begeman, Houston; Chairman A. R. Diamond, Philadelphia; Prof. J. N. Edmondson, Columbus and Prof. William W. Gilbert, Waterloo Area.

Metallurgist Addresses Des Moines ASTE Chapter

Des Moines—Dr. Bruce A. Rogers, senior metallurgist at the Institute for Atomic Research, Iowa State College, Ames, was the technical speaker at the June 18 meeting of the Des Moines ASTE chapter. His discussion centered on new metals and new uses for metals and was highlighted with slides.

News Directory

Officers to Speak at Chicago ASTE Meeting

Chicago—First Vice President Roger F. Waindle and Treasurer Howard C. McMillen will be guests at the opening autumn meeting of the Chicago ASTE chapter on September 10. They will speak to Society members on the future plans of ASTE, highlighted the research activities of the organization.

The meeting will follow dinner served at the Keymen's Club and will also include a technical session presented by Allan Gunderson, chief tool engineer with the Gorton Machine Co., who will talk on pantography.

Society Will Charter 100th Chapter Oct. 14

Marking another milestone in the history of the Society is the founding of the ASTE's 100th chapter in Athol, Mass. The new group to be chartered on Oct. 14, will be named the North Central Massachusetts Chapter.

National President L. B. Bellamy and Executive Secretary Harry E. Conrad will be on hand for the event. President Bellamy will present the charter to the new chapter. Past presidents have been invited to participate in the ceremonies.

Roger Gay, president of the Bristol Brass Corp. and president of the National Standards Assoc. will be the speaker. The toastmaster will be A. H. d'Archabal.

Blake Discusses New Metal Removal Theory

Dayton—ASTE members in Dayton met June 9th at Suttmillers Restaurant to hear K. R. Blake, consulting physicist and vice president of Metaloid Corp., deliver an address on his entirely new concept of metal removal.

The technical session, preceded by dinner and a short business meeting, was attended by 60 members of the Society and their guests. Nearly everyone present participated in the highly stimulating question and answer period.

Golfing and a party were the order of the day on July 10 when the chapter met for its annual outing.

Named Sales Manager

Edmund J. Klonowski, member of the Buffalo-Niagara Frontier chapter, has been promoted to the position of sales manager of the Punch Div., Pivot Punch and Die Corp., North Tonawanda, N.Y.

The national headquarters building of ASTE was toured recently by a group of foreign engineers visiting the United States to study American operating procedures. Here John Holt (far left) explains preparations necessary before the forthcoming *ASTE Die Handbook* can be published. Others shown, from left: Cal Burke of national ASTE staff; Mr. Firatli, Turkey; Herbert Nitsche, Germany; Gunther J. Speyer, guide for the engineers' national tour; L. Champetier, France; Maurice Dumas, France.

Philadelphia Chapter Honors Top Students

Philadelphia—Top men in die designing and tool engineering courses at Spring Garden Institute, affiliate members of the Philadelphia ASTE chapter, were honored at the June 12 graduation exercises by the chapter which awarded prizes to the outstanding students. The presentations were made by the Philadelphia's first vice chairman, Campbell R. Pittsinger, who made the awards at the Bellevue Stratford Hotel.

Rockford Meeting Scheduled September 4

Rockford—ASTE members in Rockford will open the autumn meeting scheduled September 4 when Judson H. Mansfield, director of engineering, Greenlee Bros. & Co., will present a technical session. His topic will be "Economics of Transfer Machines in Mass Production."

Mr. Mansfield is an authority on transfer machines. He began work with Greenlee Bros. in 1905 as a pattern-maker apprentice. He transferred to engineering in 1907, became chief engineer of machine division in 1918 and in 1945 was made director of engineering.

Coffee speaker at the meeting, open to members only, will be Russell Smith, Rockford attorney.

Tour Takes Members to National Mfg. Co. Plant

Cleveland—More than 75 members of the ASTE chapter in Cleveland toured the National Screw & Mfg. Co. at their June 24 meeting. Scott Rogers and his staff of engineers guided the chapter through the plant and answered questions on National's production of fasteners which are used all over the world. Instrumental in setting up the tour was David Samuelson, chief engineer, who made most of the plans for the visitation.

A roast beef luncheon served by the firm to all ASTE visitors preceded the tour.

Fall meetings of the chapter will be launched by a technical session scheduled for September 12.

ASTE's national book committee held a recent meeting in Detroit to discuss the publishing activities of the Society. Pictured here, seated from left, are: Morris M. Clemons, Edward A. Reed, W. J. Potthoff, Pres. L. B. Bellamy, and Phillip C. Wood. Standing: Chairman Francis Sehn, Ralph F. Weil, Technical Editor Frank Wilson, Ray Wilcox, N. L. Kenerson and Assistant Editor John Holt.

Greve Named Editor of *The Tool Engineer*

JOHN W. GREVE

The American Society of Tool Engineers announces the appointment of John W. Greve as editor of *The Tool Engineer*.

Gilbert P. Muir resigned as editor of the magazine to enter another field. He is now associated with Eglinton Carbide Products, Inc., and will be located in Pittsburgh, Pa. Mr. Muir joined the magazine in 1948.

With more than 20 years of experience in editorial work and technical writing, Mr. Greve has a wide background in mechanical and electrical design and production methods.

He has served in various capacities on the editorial staff of *Machine Design*, having been both managing editor and associate editor of the magazine. Previously, he was with the Westinghouse Electric Corp. in East Pittsburgh where he had more than 10 years experience in technical writing and editing.

A graduate of Carnegie Institute of Technology, Mr. Greve is a registered professional engineer, a member of the Society for Experimental Stress Analysis, an associate member of the Society of Business Magazine Editors. A life member of the Cleveland Engineering Society, he served in many offices for that organization including the chairmanship of the machine design division and as president of the society.

Pittsburgh Members to Hear Newspaper Reporter

Pittsburgh—Pulitzer prize-winner Ray Sprigle, feature reporter with the *Pittsburgh Post-Gazette*, will speak to members of the Pittsburgh chapter September 12 at a meeting to be held at the Churchill Valley Country Club.

Picnic Substitutes for ASTE Technical Session

Cedar Rapids—The sports party of the Cedar Rapids chapter was held June 13 in the ZCBJ Park. Nearly 150 members and their guests enjoyed various events, ranging from horse-shoe pitching and volley ball to cards and just plain sociability. Dinner was served and the remainder of the evening was spent enjoying informal entertainment.

Lahr Resigns

Eugene J. Lahr has resigned from his position as technical manager with Panambra in South America to become a technical consultant for a number of Brazilian companies. His address is Caixa Postal, 4364 Sao Paulo, Brazil.

Stainless Steel Topic at Los Angeles Session

Los Angeles—Technical sessions for the ASTE chapter in Los Angeles are continuing through the summer months. On July 10 the members met at Scully's to hear J. E. Turk, assistant area manager, Allegheny Ludlum Steel Corp., speak on stainless steel.

The speaker was introduced by Chapter Chairman Ralph L. Chrissie.

Three films were featured at the meeting. One on melting and refining of modern steels showed the processing of high alloy stainless steels and the many controls necessary to produce high quality. Another movie was titled "Manufacturing of Stainless Strip." The film on exploring the micrometer, taken at ultra high speed, showed the slowed down action of tools against work.

A stimulating question and answer period concluded the session.

Los Alamos Publishes First Issue of Newspaper

Los Alamos—Although summer is usually a quiet season for ASTE activity, Los Alamos marked a special event when the first issue of the "Atomic City Tool Engineer" rolled off the presses in July.

Featured at the June 5 meeting of the chapter was a program presented by the Carpenter Steel Co. Speakers were Mr. O'Neil and Mr. Styling who showed slide films on heat treatment failure.

A lively discussion period was included at the technical session.

Preceding the program was a dinner served to close to 75 members and guests at the Los Alamos Civic Club.

News of the chapter includes the recent move made by Wilbur Hoffman who has left the area to work for Howard Hughes in Luzon, Arizona. Mr. Hoffman was formerly associated with the Frigidaire Div. of General Motors in Dayton.

A group of happy Golden Gate members and their wives is shown here in a photograph taken at the annual ladies' night party held June 12 at the Moose Club Patio in Oakland. The big social event of the year was attended by nearly 70 couples. The Golden Gate chapter made news this summer when it was announced the membership goal for 1952 (300 members) had been reached and that the chapter has set its cites on 400 before Christmas.

New Position for DeRoche

Walter DeRoche, secretary of the Cincinnati chapter and formerly with the Hamilton Tool Co., has taken a position as tool engineer with the ABCO Tool and Die Co., Milford, Ohio.

Cleveland ASTE members are pictured on the tour of the National Screw & Mfg. Co. taken by the chapter June 24. From left: Bob Southwell, past chairman; Andy Clark, past chairman; E. P. Simon, vice president, Ohio Machine & Boiler Co.; Gordon Carlton; Bertha Wellman, industrial press editor; Glen Hier; Emil J. Sebek, vice president, White Sewing Machine Co.; and C. L. Christy, chapter secretary. A roast beef luncheon was served by the firm to more than 75 ASTE visitors participating in the tour.

First Annual Picnic Held by Long Island

Long Island—Everything about the first annual picnic staged by the Long Island chapter was successful except the weather, and even it made a few concessions now and then to make the day an enjoyable one for ASTE members and their families.

Timber Point furnished the setting for the June 21 event. Contests of every type were offered for the fun of all those present. Children participated in foot and sack races. Nail-driving contests, backward races, wheelbarrow races and an egg-tossing contest attracted the adults who also took part in an egg-on-the spoon race and a golf hole-in-one competition.

Prizes for the winners were provided by R. J. Atkinson, Inc., Bock Mfg. Co., Cosa Corp., Harrington Wilson Brown Co., Monarch Machine Tool Co., Morse Twist Drill Co., Panco Mfg. Co., Shaw Metal Products, L. S. Starrett Co., Triplex Machine Tool Co., and Perry J. Wilson, Ltd.

Chairman of the entertainment committee Don L. Griffing was assisted by Herbert Murphy, co-chairman. Games were handled by John Barnes and his committee. Others who helped in making the outing a success were Mrs. Harold Eaton, Arthur Cervenka, John Turner, Harold Poett, Richard Van Harken, Neal Watson, Arthur Edstrom, Roland Kainen, Rudy Osterholm, Charles Vanderhood, George J. McLaughlin, William Rogers, Harold Eaton, Earl Niedershuh, Emil Zajic, H. S. Shlimbaum, Charles Smith, James Finnegan and Bob Mechanik.

Joseph Kielb Named Production Manager

Joseph V. Kielb, member of the Northern New Jersey ASTE chapter, has been named production manager of both Newark plants of Tenney Engineering, Inc. His background includes such positions as works manager, assistant chief engineer, chief engineer, and plant superintendent.

Mid-Hudson Chapter Enjoys Annual Picnic

Poughkeepsie—Families and guests of Mid-Hudson members joined the ASTE chapter on June 19 for the sixth annual picnic held at Shadyside Park. Nearly 300 persons attended the event.

Games for all were featured during the afternoon. Various types of races were on the program followed by a tug-of-war and a baseball game. Prizes were awarded to the winners of each contest.

Hamburgers and frankfurters were served at the afternoon festivities and a buffet supper rounded out the full day of fun.

General arrangements for the picnic were under the direction of Richard Fitzgibbon, chairman of the picnic committee. Other members assisting were: Fred Henning, prizes; Joseph Spahn, beverages; Henry J. Tesmer, sports; Frank A. Plotnik and Joseph C. Petz, tickets; Ted Restau, food.

Members of the executive committee who also assisted were Joseph A. Crane, Stanley Cook, Ray Lansing, Joseph Nelson, W. A. Stadtler, Russell F. Sanford, C. Peter Barone and Harry N. Carlson.

Boston Outing Draws 200 Members, Guests

Boston—Competitive sports, dinner and entertainment starred at the outing held by the Boston chapter June 7 at the Stow Country Club. Invitations were extended to Little Rhody members to participate in the day's activities. More than 200 members and guests attended the annual picnic.

The golf tournament drew 77 contestants. Members Fitzgerald, Peterson, Koschen, Marizzo, Merrill, Hughes, Klopfleisch and Bown won prizes for their scores of 79. High man Burt Gundor was also awarded a prize. A long drive contest was won by Little Rhody member C. George.

The Boston chapter defeated Little Rhody by a score of nine to three. Ralph Schute and Tony Effgen, Jr., were winners in the horse-shoe competition.

Colored movies were taken during the day for showing at an autumn meeting and will be available on loan to any chapter that wishes to see them.

Sanborn Named Sales Manager for Fellows

George H. Sanborn, Detroit district manager and chief field engineer for the Fellows Gear Shaper Co., has been named sales manager to succeed Leroy C. King, who retired after 41 years in service and sales work for the company. Mr. Sanborn is a member of the ASTE chapter in Detroit.

More than 200 persons witnessed the presentation of the past chairman's pin to Bud Thuman (left) made by Walter V. Stippler at the July 14 meeting of the Evansville chapter. The occasion was the annual picnic and past chairmen's night.

Harold Murch Talks on Optical Comparators

Evansville—"The Use of the Optical Comparator" was discussed by Harold Murch, chief optical engineer, Jones & Lamson Co., in his technical address before the Evansville chapter at June meeting.

He presented many aspects of this modern measuring instrument and many unique applications were shown in the slides which accompanied the lecture.

About 120 members and guests were on hand for the meeting.

Appointed Production Manager at Daco

Baltimore member Herbert L. Schwartz has been appointed production manager for the Daco Machine & Tool Co., manufacturers of aircraft precision instruments and specialists in instrument tooling programs. Associated with Daco since 1948, Mr. Schwartz was formerly assistant to the general manager.

Pontiac Group Tours Franklin Products Co.

Franklin, Mich.—A presentation of the products, equipment and plant facilities of Franklin Products Co. was made to members of the Pontiac chapter on their tour of the firm on June 3. A special skeleton crew was on hand to demonstrate the more interesting operation in turning out tubular stock for aircraft and automobiles.

William Weightman, process engineer, gave highlights of the company's growth from a small one-room shop to its present modern building. Other Franklin executives who guided the tour were Franklyn Collins, president; Winfield Hinman, electrical engineer and Ken Berridge, tool room supervisor.

Refreshments were served to the group at the tour and were provided by the company.

Saginaw Holds Outing

Bay City—Saginaw Valley members held their annual golf outing at White Birch Hills on June 21. More than 140 members and guests participated in the event which included lunch and dinner. Golf winners were presented prizes for their low scores.

Klema Discusses Pantograph Machine

Syracuse—The closing meeting of the ASTE season was held at the Deauville Hotel at Owasco Lake, Auburn, N. Y., on June 10. Syracuse members and their guests turned out 130 strong to hear Harlow Klema, sales manager, George Gorton Machine Co.

Arrangements for the program were made by Robert D. Fulford, who introduced the speaker, and John Dugan.

Mr. Klema, who has been with the Gorton Co. for the past 17 years, gave an illustrated talk on the use of the pantograph machine and the high degree of precision that is obtainable with these machines.

Pictured at the speakers' table at the closing meeting of the Syracuse chapter held June 10 are (left to right): Carl J. Hoffman, Victor Fitting, R. D. Fulford, Harlow Klema, A. C. Vesper, E. B. C. Bloom and R. D. Coseo.

News Items from the West Coast

By Andrew E. Rylander

What with the summer recess and members on vacation or rollicking at golf parties and clambakes, I can find space for a composite answer to the many letters received during the past several months. Not that I haven't acknowledged them, having to set a good example and all that, but I've an idea that a bit of chit-chat will be a bit of diversion for our readers during the dog days.

As a starter, I've a letter from W. J. Williams, acting director, School of Shop Practice, Internat'l Correspondence Schools, saying that he is now an ASTEer and proud of his membership. In my role of unofficial greeter I welcome him into the ASTE fold which, according to a memo from Harry Conrad, has grown mightily during the past year. So "on with the ASTE!"

One live-wire ASTEer wrote me asking my opinion on a chapter home or club house, which I referred to Society H. Q. While I'll hold my correspondent anonymous a/c he may wish to survey the ground a bit before springing it on his fellow chapter members, I'll put myself on record as saying that it's a swell idea. Years ago, I was member of a benefit association—Vasa Orden, to be exact—of which many chapters have their club houses. One that I know of is located near Providence, R. I. Another is in the Detroit area.

To digress, the kids just breezed in from down the Valley, thinking to excape the heat. But it's hot in Walnut Creek, too, really a sizzler! Very unusual, of course. So, we decided on a tour that took in Mt. Tamalpais and adjacent redwoods although the ultimate goal was a beach where one hunts semi-precious stone. We finally got there by devious and tortuous ways but, finding no agates, bucked the breakers instead.

The grandchildren fished a baby bird out of mountain brook which, in its present stage of development—the bird, that is—may be termed of unknown species. Anyway, I've been appointed nursemaid, apropos which I've been feeding it everything from earthworms to ice cream. Mixed diet, y'know. Oh, I have my diversions.

Speaking of diversions, I've been building a patio adjacent to the backyard pool, all in addition to a major landscaping project. It's really shaping up! What pleases me particularly, though, is that I've put in several days from dawn to dusk at really hard work and without being overly tired. A year ago that would have floored me. Now, I can take it, and getting browned like an Indian to boot. Trouble with working with redwood, though, is that you're forever digging splinters out of your hands. No end of diversions!

Getting back to letters, the question most generally asked is: How do I like California? The answer is: Fine! No more headaches, for one thing, and they've been the bane of my existence for years on end. And as for the weather, you can have your choice of hot, warm, cool or cold within an hour's drive from almost anywhere in the state. Nights are always comfortably cool for sleeping.

Coming in late last summer, the hills looked drab and dreary. Then the rains came—and how they came—and the hills slowly greened from soft pastel shades to breath-taking, verdant beauty. At twilight—and here, the sunsets are gorgeous!—they merge with the clouds into magnificent distances, their flanks a luminescent blue against the rose of the skyline. But enough of that, I'm poaching on chamber of commerce territory and not even getting paid for it.

One thing strikes me as odd. Back in Detroit, we'd work in our shirtsleeves, at least during hot weather. And in Walnut Creek there's no formality; women go around in the briefest shorts and men in these polychrome California shirts. But you go into an office in San Francisco and you find the men wearing coats and even vests during weather when anything short of nothing is a lot too much.

Coming Meetings

INTERNATIONAL AREA MEETING—Oct. 10, 11. Hotel Statler, Buffalo, N. Y.

CHICAGO—Sept. 10, Keymen's Club. First Vice President R. F. Waindle, and Treasurer H. C. McMillen will be guest speakers. Technical session presented by Allan Gunderson, chief tool engineer, Gorton Machine Co.

PITTSBURGH—Sept. 12, Churchill Valley Country Club. Ray Sprigle, feature reporter, *Pittsburgh Post-Gazette*.

PIEDMONT—Sept. 26, 27. Meeting with national officers of ASTE.

ROCKFORD—Sept. 4. Judson Mansfield, director of engineering, Greenlee Bros. and Co., will speak on "Economics of Transfer Machines in Mass Production."

Easterners especially have to get used to traffic conditions. Roads are congested and, except for trunk arteries like U.S. 50 and 99, winding and hilly. However, the state is putting in freeways as fast as the funds are provided. And right here, I can't bestow too much praise on California highway engineers. They're doing a swell job, and let me tell you that running a road over flat prairie is ducksoup compared to carving them out of mountainsides and constant battling with landslides.

Accidents are plentiful and bad, only the worst ones getting into the newspapers. In proportion to car registration, however, they're probably no more prevalent than in most states. In my belief, they are caused more by a combination of slow and fast driving than by speed alone. As everywhere, a certain percentage of drivers either straddle the road at a snail's pace or hog the high speed lane; consequently, other drivers going at legal speeds must pass to the right to get by.

Stating my own opinion for what it's worth, the automobile long since ceased to be a mere pleasure car; it's a business vehicle, a means of transportation for people who must bridge distances in the making of a living. People in that class are usually fast drivers, and invariably safe drivers. The unsafe drivers are the slowpokes and the repeaters.

Another question: Do I miss old friends? The answer is "no." I don't miss them because they are always with me, to be conjured to my side at a whirr of the wheel of memory. Many, of course, have crossed the final horizon, and of the rest, there are many I will never see again in this life. But, they are not forgotten nor, where true friendships are concerned, am I forgotten.

To my friends, then, I say this: wherever you may be, in Canada or the United States, or across the seas, you are held fresh in mind and so cannot be missed except as there are times when I long for your smiles and your handshakes. To that, I might add that the welcome sign is up whenever you feel like paying a visit.

Well, now that I've stated my views about California, I suppose you'd like to rib me about that earthquake we had down the southern end a while back. Well, earthquakes are bad enough although in terms of life and property losses no worse than the losses caused by floods, tornados, heavy snows or other catastrophies in other parts of the country. As for that, we've been rocked by blasts of oratory and near oratory from the Chicago convention, and after breasting that one can stand anything. Well, it's a long lane that has no turning . . . I hope. And that, my friends, will be all for now.

Directory of ASTE Chapter Chairmen

AKRON No. 47
Third Tuesday
Allison Orvis Hunt, 124 N. Harmony St., Medina, O. Phone: 2-4332

ALBUQUERQUE No. 93
First Friday
Jerome F. Durrie, 3350 48th Loop, Sandia Base, Albuquerque, N.M. Phone: 5-5511, Ext. 3-3193

ATLANTA No. 61
Third Monday
Frank Frost Ford, 67 The Prado, N.E., Atlanta 5, Georgia. Phone EMerson-2153

BALTIMORE No. 13
First Wednesday
Leon E. Laux, 900 E. Fairway Dr., Towson 4, Maryland. Phone: Towson-0315

BINGHAMTON No. 35
First Wednesday
William A. Leindecker, 42 Orchard Ave., Johnson City, New York. Phone: 7-2082

BOSTON No. 33
Second Thursday
Harold L. Seekins, 17 Ridge Rd., Marblehead, Mass. Phone: Marblehead-3196-M

BUFFALO-NIAGARA No. 10
Second Thursday
William L. Clarke, Ex-Cell-O Corp., 923 Kensington Avenue, Buffalo 15, New York. Phone: PArkside-5202

CEDAR RAPIDS No. 71
Third Wednesday
Edwin Klouda, Sixth & Prairie Ave., S.W., Cedar Rapids, Iowa. Phone: 3-2522

CENTRAL PENNSYLVANIA No. 22
First Monday
Burnell C. Stambaugh, Hanover Tool & Specialty Works, 449 York St., Hanover, Pa. Phone: 3-3240

CHICAGO No. 5
Second Tuesday
H. Verne Loeppert, 9925 Karlov Ave., Skokie, Ill. Phone: Skokie-4912

CINCINNATI No. 21
Second Tuesday
Joseph Aprile, 3715 Brotherton Rd., Cincinnati 9, Ohio. Phone: ME 2943

CLEVELAND No. 3
Second Friday
A. B. Clark, Haynes Stellite Company, 1517 Superior Ave., Cleveland 14, Ohio. Phone: CH 1-5366

COLUMBUS No. 36
Second Wednesday
Jack E. Mitchell, 344 South Brinker Ave., Columbus 4, Ohio. Phone: Randolph-2971

DAYTON No. 18
Second Monday
Richard M. Blair, 7406 Harry Truman Drive, Dayton 3, Ohio. Phone: OL 4902

DECATUR No. 58
Last Tuesday
Fred W. Sobottka, 1620½ E. Cleveland, Decatur, Ill. Phone: 9564

DENVER No. 77
First Wednesday
F. J. Geoffroy, The Geoffroy Company, P. O. Box 67, Capitol Hill Sta., Denver 6, Colorado. Phone: Fremont-8188

DES MOINES No. 30
Third Wednesday
Howard E. Campbell, 2733 Adams Ave., Des Moines 10, Iowa. Phone: 7-9381

DETROIT No. 1
Second Thursday
Edward D. Wiard, Illinois Tool Works, 2895 E. Grand Blvd., Detroit 2, Mich. Phone: Trinity 4-1880

ELMIRA No. 24
First Monday
Raymond F. Banfield, 134 Catalpa Drive, Horseheads, N.Y. Phone: Horseheads-859-M

ERIE No. 62
First Tuesday
Walter S. Cebelinski, 320 East 31st St., Erie, Pa. Phone: Erie 04-308

EVANSVILLE No. 73
Second Monday
Henry J. Pernicka, 4617 Taylor Ave., Evansville, Ind. Phone 6-0622

FAIRFIELD COUNTY No. 6
First Wednesday
Mason B. Whiting, Box 12, Redding Ridge, Conn. Phone: Redding-94

FOND DU LAC No. 45
Second Friday
Paul V. Rohling, Vollrath Company, 1236 N. 18th St., Sheboygan, Wisc. Phone 4851

FORT WAYNE No. 56
Second Wednesday
Everett R. Keese, Bowser, Inc., 1302 E. Creighton Ave., Fort Wayne 2, Ind. Phone: H-2341

FOX RIVER VALLEY No. 72
First Tuesday
George R. Parsons, 486 Ann St., Elgin, Ill. Phone: Elgin-5692

GOLDEN GATE No. 28
Third Wednesday
Ted J. Rohrer, Pratt & Whitney Div., 1331 Howard St., San Francisco 3, Calif. Phone: MArket 1-7363

GRAND RIVER VALLEY No. 81
First Friday
David E. McCready, 19 St. Arnaud St., Guelph, Ontario, Canada. Phone: 3674

GRANITE STATE No. 86
Second Tuesday
James David Wilson, 18 Carisbrooke St., Andover, Mass. Phone: Andover 188-J

HAMILTON No. 42
Second Friday
William McKee Shaw, 9 Harrison Ave., Guelph, Ontario, Canada. Phone: 2291-R

HARTFORD No. 7
First Monday
Henry E. Kuryla, Norden Instruments, Inc., Wiley St., Milford, Conn. Phone: 2-6721, Ext. 213

HOUSTON No. 29
Second Tuesday
George L. Freeman, Steel & Machine Tool Sls. Co., P. O. Box 1716, Houston 1, Texas. Phone: WA 7113

INDIANAPOLIS No. 37
First Thursday
Denis F. White, 1222 E. New York St., Indianapolis 2, Ind. Phone: Franklin 3196

JACKSON No. 87
Third Monday
Edwin G. Small, Dawlen Corp., 1911 Fargo Rd., Jackson, Mich. Phone: 7137

KANSAS CITY No. 57
First Wednesday
John W. Hoover, 3212 Jefferson St., Kansas City 2, Mo. Phone: Logan 1435

LaCROSSE No. 96
Fourth Tuesday
John David Holly, 220½ 19th St., LaCrosse, Wisc. Phone: 2-4688

LANCASTER, GREATER No. 89
Second Tuesday
Willis M. Houck, 54 Union St., New Holland, Pa. Phone: New Holland 4-8262

LEHIGH VALLEY No. 83
Third Friday
John Eaton, 408 North 26th St., Allentown, Pa., Phone: Allentown 2-7224

LIMA No. 97
Third Thursday
R. J. Schimpf, 842 W. Elm, Lima, Ohio. Phone: 7-5623

LITTLE RHODY No. 53
First Thursday
Matthew J. Grochmal, 82 Bryant St., No. Dartmouth, Mass. Phone: JA 1-2053

LONDON-ST. THOMAS & DIST. No. 91
Third Thursday
Albert H. Ward, 48 Apeldoorn Crescent, London, Ontario, Canada. Phone: 3-5601-R

LONG BEACH No. 84
Second Wednesday
Frank D. Wallace, 2906 Petaluma Ave., Long Beach 4, Calif. Phone: 50778

LONG ISLAND No. 88
Second Monday
William W. Rogers, L. I. Agr. & Tech. Inst., 520 Conklin St., Farmingdale, L. I., N. Y. Phone: Farmingdale 2-2506

LOS ALAMOS No. 92
1st Thurs. after 1st Wed.
Norman C. Blezek, 3226-A Walnut St., Los Alamos, N. M. Phone: 2-2119

LOS ANGELES No. 27
Second Thursday
Ralph Louis Chrissie, Hollywood Mfg. & Sup. Corp., 720 Towne Ave., Los Angeles 21, Calif. Phone: TR 7061

LOUISVILLE No. 54
Second Tuesday
Robert F. Stucker, 3211 Oriole Drive, Louisville 13, Ky. Phone: MA 5-953-W

MADISON No. 75
Second Tuesday
Charles W. Neff, 2321 Kendall Ave., Madison 5, Wisc. Phone: 3-1583

MID HUDSON No. 74
Second Tuesday
Joseph A. Crane, Intn'l Business Mach. Corp. Engineering Laboratory, Box 390, Poughkeepsie, N. Y. Phone: 6920, Ext. 591

MILWAUKEE No. 4
Second Thursday
Waldemar E. Klein, 7624 West Walker St., Milwaukee 14, Wisc. Phone: Greenfield 6-2737

MOHAWK VALLEY No. 78
Fourth Tuesday
Albert Charles Delmont, 812 Arnold Avenue, Utica 2, N. Y. Phone: 2-2907

MONTREAL No. 50
Second Thursday
Creighton Joseph McDowell, 5020 Randall Ave., Montreal 29, Quebec, Canada. Phone: DExter 3071

MUNCIE No. 70
First Tuesday
Lake Lavon Deane, 2005 S. Hackley, Muncie, Ind. Phone: 5-226

NASHVILLE No. 43
Third Tuesday
John W. Gipson, 610 Shady Lane, Nashville 6, Tenn. Phone: 3-5673-W

NEW HAVEN No. 41
Second Thursday
John H. Alton, Eastern Machine Screw Corp., Truman & Barclay Sts., New Haven 10, Conn. Phone: 7-5724

NEW ORLEANS No. 60
First Tuesday
James R. Cypher, Chrysler Corporation, P. O. Box 460, New Orleans, Louisiana

NEW YORK, GREATER No. 34
First Monday
Eugene Roth, Eugene Roth Co., Inc., 250 West 57th St., New York 19, N. Y. Phone: Plaza 7-8470

NIAGARA DISTRICT No. 65
First Thursday
John Michael Marchyn, Tri-Sure Prod. Ltd., 264 Welland Ave., St. Catharines, Ontario, Canada. Phone: MU 5-8475

NORTH TEXAS No. 51
Last Friday
Arnold E. Unruh, 708 Roberts Cutoff, Fort Worth 14, Texas. Phone: PE 5807

NO. NEW JERSEY No. 14
Second Tuesday
Clyde C. Shannon, 1508 Burnett Ave., Union, N. J. Phone: Union 2-6648-R

PEORIA No. 31
First Tuesday
William H. Logue, 3018 Springfield Rd., E. Peoria 8, Ill. Phone: 3-4070

PETERBOROUGH No. 94
First Thursday
Robert R. Dyer, 247 Wilson, Peterborough, Ontario, Canada. Phone: 2-4453

PHILADELPHIA No. 15
Third Thursday
Albert B. Luecke, 622 Bover Rd., Cheltenham, Pa. Phone: Cheltenham 8005

PIEDMONT, No. 82
Second Monday
Charles J. Rix, 828 Melrose St., Winston-Salem, N. C. Phone: 4-1845

PITTSBURGH No. 8
First Friday
Fred Hennig, Jr., Kennametal, Inc., 600 Grant St., Pittsburgh 19, Pa. Phone: AT 1-4543

PONTIAC No. 69
Third Monday
Ronald J. Hayward, 231 Starr St., Pontiac 18, Mich. Phone: FE 2-8909

PORTLAND, ME. No. 46
Second Friday
John J. Green, Thomas Laughlin Company, 143 Fore St., Portland 6, Maine. Phone: 3-1791

PORTLAND, ORE. No. 63
Third Thursday
Daniel J. Melody, 4727 N. E. 74 Ave., Portland 13, Ore. Phone: TR 7054

POTOMAC No. 48
First Thursday
William E. Jones, U. S. Naval Gun Factory, 8th & M Sts., S. E., Washington, D. C. Phone: Fr 5700, Ext. 2193

RACINE No. 2
First Monday
John George Obermeyer, R 3, Box 176, Racine, Wisc. Phone: 2-3886

RICHMOND No. 66
Second Tuesday
James C. Brindell, 408 So. 23rd St., Richmond, Ind. Phone: 7-1721

ROCHESTER No. 16
First Monday
Charles L. DeMartin, General Screw Products Corp., 63 Mt. Hope Ave., Rochester, N. Y. Phone: Hamilton 6750

ROCKFORD No. 12
Second Thursday
Bruce H. Lundgren, Sundstrand Machine Tool, 2531 11th St., Rockford, Ill. Phone: 24477

SAGINAW VALLEY No. 68
Third Thursday
Clyde L. Fanning, 3128 Norwood Drive, Flint 4, Mich. Phone: 9-5160

SAN GABRIEL VALLEY No. 95
First Thursday
Edw. A. Smith, Day & Night Mfg. Co., 700 Royal Oaks, Monrovia, Calif. Phone: Elliott 8-3211

ST. LOUIS No. 17
First Thursday
Erwin Paul Huchzermeier, 4934 Miami St., St. Louis 9, Mo. Phone: Flanders 1567

SALT LAKE CITY No. 85
First Friday after first Wednesday
John F. Woodhead, 2477 Skyline Drive, Salt Lake City 5, Utah. Phone 8-3162

SAN DIEGO No. 44
Second Tuesday
Arthur E. Crom, 1759 Oliver Ave., San Diego 9, Calif. Phone: H 8-2682

SCHENECTADY No. 20
Second Thursday
A. Edmund Lee, Box 1151, Scotia 2, N. Y. Phone: Burnt Hills 6121

SEATTLE No. 39
Fourth Tuesday
A. J. Gembolis, 4501 Greenwood Ave., Seattle 3, Wash. Phone: HE 5919

SOUTH BEND No. 30
Second Tuesday
Lawrence Haverstock, 2515 Mishawaka Ave., South Bend 15, Ind. Phone: 3-1063

SPRINGFIELD, ILL. No. 64
First Tuesday
Robert C. Peck, 541 South Lincoln, Springfield, Ill. Phone: 2-8516

SPRINGFIELD, MASS. No. 32
Second Monday
William F. Buckley, 142 Chapin Terr., Springfield, Mass. Phone: 3-2567

SPRINGFIELD, OHIO No. 76
Second Tuesday
Kenneth A. Forsell, 324 Ogden Rd., Springfield, Ohio. Phone: 3- 2738

SYRACUSE No. 19
Second Tuesday
Albert C. Vesper, 419 Durston Ave., Syracuse 6, N. Y. Phone: 74-3130

TOLEDO No. 9
Second & fourth Wednesday
Elmer L. Faber, 4162 Berwick, Toledo 12, Ohio. Phone: Kingswood 1007

TORONTO No. 26
First Wednesday
Fred J. E. Lockhart, Atlas Steels Ltd., 30 Ordnance Street, Toronto, Ontario, Canada. Phone: EMpire 4-2431

TRI-CITIES No. 23
Second Wednesday
Gilbert H. Jording, 2015 42nd St., Rock Island, Ill. Phone: Rock Island 6-6039

TULSA No. 90
Second Thursday
John H. Keyes, 1342 South Norfolk, Tulsa 14, Okla. Phone: 4-5963

TWIN CITIES No. 11
First Wednesday
Don Reiner, 5328 Bloomington, So. Minneapolis 7, Minn. Phone: PL 6973

TWIN STATES No. 40
Second Wednesday
Robert Wm. Laffin, Laffin Supply Corp., 22 Commonwealth Ave., Springfield, Vt. Phone: 2597

WATERLOO AREA No. 79
Fourth Wednesday
David D. Lowber, 1321 Brooklyn Ave., Ann Arbor, Mich. Phone: 2-7916

WESTERN MICHIGAN No. 38
Second Monday
Robert J. Maguire, Good Steel Service, Inc., 1010 Leonard St., N. W., Grand Rapids, Mich. Phone: 9-0213

WICHITA No. 52
Second Wednesday
Orville B. Strahm, 601 S. Terrace Dr., Wichita 9, Kans. Phone: 6-1706

WILLIAMSPORT No. 49
Second Monday
Morris C. Smith, 198 Broad St., Montoursville 1, Pa. Phone: 8-1114 (Williamsport)

WINDSOR No. 55
Second Monday
David C. Heath, 460 Sunset Ave., Windsor, Ontario, Canada. Phone: 3-6135

WORCESTER No. 25
First Tuesday
E. Roland Ljungquist, 37 Winifred Ave., Worcester 5, Mass. Phone: 3-8362

News in Metalworking . . .

DOW SHARES KNOW-HOW ON PARTING AGENT PROBLEM WITH SHELL MOLDING INDUSTRY

Adhering to one of the higher traditions of industry—the swapping of technical information and as a consequence, helping to increase the pool of knowledge—the Dow Corning Corp. has offered a concise report on its experience in connection with parting agents for foundry shell molding operations. Secretive tendencies by many foundries, as a result of patent problems, etc., has had some effect toward slowing general progress development since each must feel his own way more or less unaided.

In presenting its method of casting, Dow points to a number of features that experience with their process has shown to be typical; the low machining required—in many instances, it is said, 50 percent less than for those made from conventional sand molds—high dimensional accuracy and fine surface finish with a consequent savings in metal and machining time; the ease with which thin sections may be cast, step-up in production; and the reduced sand to casting weight ratio. These advantages, Dow engineers say, are attributable to the proper release agent which allows production of the cleanest, easiest release possible of molded shells from the pattern plate. Silicones, with their relative inertness to organic materials and their resistance to decomposition at molding temperatures, seem to prove themselves ideal for the job. In addition they have the advantages of being easy and economical to apply.

These plaudits do not, however, mean that all casting problems are over. Effective as silicone release agents may be, specific rules do not govern the amount, type and method of applying the materials in a given application. And it is extremely important that every new metal mold or form be given a preliminary break-in run. This often is true too for metal molds or patterns which have just been thoroughly cleaned.

Proper Break-in Outlined

Break-in method recommended by Dow as possibly the simplest is to rub a generous coating of the silicone parting agent to the pattern and then heat the pattern for a short period of time at the usual operating temperature. Intricate or deep draw patterns, they say, may require a second or even a third such treatment to prepare them completely. This point reached, the pattern is ready for production and should be lubricated with the diluted parting agent.

Liberal application of silicone release agent to patterns is recommended by the Dow engineers only for break-in runs and not for production runs. Their experience has proved, they say, that after the pattern is broken in, it is better to apply a dilute dispersion of silicone often than to apply the more concentrated release agent at infrequent periods. Heavy concentrations provide multiple releases, but the infrequency offers the possibility of forgetfulness on the part of the operator to miss the proper timing of a reapplication and a sudden sticker may prove rather costly.

Silicone mold release agents were first introduced about six years ago to the rubber and plastic molding industries. Now they are considered standard materials in those industries while finding reception in a wide variety of highly specialized molding applications ranging from silver to gelatin. As a result of these successful uses, Dow began testing silicone mold release agents in the shell process during early experimental work in this country.

CONTROL PROCESS EXPLAINED FOR COATED ABRASIVES

Control of thickness and density of adhesive, abrasive and final adhesive coat to an accuracy within one percent is possible with the new production technique setup at Carborundum Company's Coated Products Division plant. So unusual is the operation that the company foresees new standards of precision attained in the manufacture of coated abrasives, with a great attendant advantage of a minimum of rejects.

Coated abrasives are used in most manufacturing activity, and modern precision grinding methods have inevitably led users to demand very close control. The industry's progress in backing, materials, adhesives and high-performance abrasive materials has been steady, but progress in production control seems to have lagged behind.

Now with the control picture a reality, it would be entirely practical for customers to order coated products to strict specifications, or to reorder with the anticipation of getting an exact duplication of a previous sample, since the process involves a complete graphic production record of every roll.

The technique installed at Carborundum, which was worked out with specialists of Industrial Nucleonics Corp., integrates five beta ray gages, actuated by radioisotopes, into the coated abrasive machine production line. In actual operation at Carborundum, this set-up works thus: gage one furnishes a base measurement; gage two picks up weight of backing plus weight of adhesive coat; gage three measures weight of backing plus weight of adhesive, plus weight of abrasive; gage four measures total weight after preliminary cure and before final adhesive application. Gage five measures final weight after the last adhesive application. These operations are on a line traveling up to 350 fpm.

In explaining the installation, William A. Wendel, vice-president and manager of the company's Coated Products Division production, stated that production control up to now in the industry has been on a cut-and-try basis. This has required stopping of machinery, cutting out an edge sample for checking, readjusting rolls and feeds. Overshooting on specifications was common, he pointed out, to make sure of meeting minimum thickness and density standards.

Radioisotope gaging on a continuous basis provides permanent graphic records on each run. Its adaptability to automatic control not only eliminates the costly and comparatively inaccurate manual testing, but also reduces machine downtime for the cut-and-try checking, and, through reducing re-

jects, allows savings in the expensive materials used, as well as preventing wastage of processed materials.

Temperature, dirt or humidity do not influence the Accuray gages. In each gage a sealed capsule of radioactive Strontium-90 emits beta rays. As the material being measured moves past the aperture between the sources and the detector unit (a special type of ionization chamber), the amount of radiation passing through the material varies according to the density of the material.

The beta rays that get through to the detector unit ionize a gas and thus create a voltage that provides a recording and controlling signal. Since the gage is calibrated, variations in beta-ray transmission cause changes in signal that vary directly with change in weight per unit area.

Signals from the gages then are translated into a trace on pen recorders for visible record. Any change may be immediately traced and corrected.

METAL CARBIDES BEGINS $1,000,000 CONSTRUCTION

A new facility with a destined monthly capacity of 25,000 lb of tungsten carbide metal, tungsten alloy heavy-metal, titanium metal and other special alloys made from powdered metals is under way for Metal Carbides Corp.

However, even with the increased area resulting with this construction the company's main plant will continue in operation.

KING GREETS GOLDEN YEAR

King Machine Tool celebrates its 50th year in the industry where it became world-renowned for its vertical boring and turning machines.

Founded by Rufus King, the business originally was incorporated as the Wais-King Tool Co. Three years later the name was changed to The King Machine Tool Company and remained so for the next 44 years, until the business was acquired by American Steel Foundries in 1948, and the company status was changed to Division.

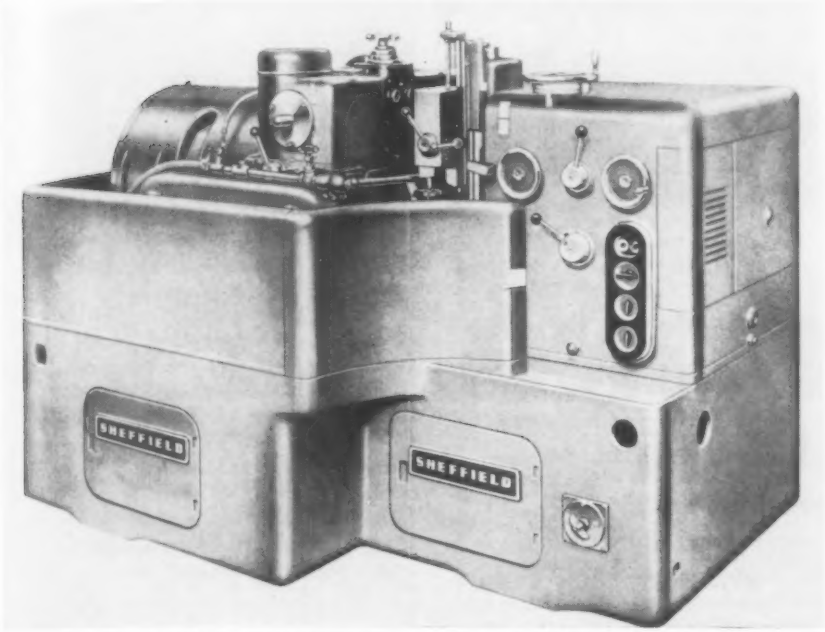
BID FOR NEW ENGINEERS EMPHASIZES SHORTAGE

The seriousness of the present personnel situation in engineering circles has been pointed up through the efforts various companies are making to attract the newly graduated engineers.

The Monarch Machine Tool Co., facing the critical situation squarely, made a pocket-sized booklet which was distributed as a recruiting measure. The booklet, well illustrated, discusses the special attractions of the machine tool industry in general and then gets down to cases with its own company in particular. Graphs impress upon the prospective employee the company's position and future growth.

Tools of Today . . . .

Precision Gear Grinding Machine



Production of a high precision gear grinding machine is announced by the Sheffield Corp., Dayton 1, Ohio. It is the first of its kind to be made and become available commercially in this country. This gear grinder is claimed to be capable of producing gears at a faster rate and with more constant uniform accuracy than has been achieved before in mass production.

The grinding method is unique in that the periphery of the wheel is formed with a helical rib by a combination of Crushtrue and diamond dressing. The gear blank, mounted on a mandrel between vertical dead centers, rotates continuously at a set rate in direct relationship to the grinding wheel into which it is fed in an upward direction during the grinding operation. Work drive and grinding wheel drive are interconnected by gearing which can be changed easily as required by the number of teeth to be ground.

Without stopping the grinding wheel, work can be removed from the machine for inspection, and when replaced, is automatically properly located without further adjustment. Two additional sets of gears provide for selecting the helical lead and for controlling the speed at which the work is fed past the wheel. The operation resembles gear hobbing with the helical ribbed wheel taking the place of the gear hob.

In addition, the work rolls across the full width of the wheel so that the involute form is generated entirely automatically and without further adjustment of the machine after its initial setting. The need for indexing is eliminated. The continuous rolling motion distributes wear evenly across the full face of the wheel, preserving the accuracy of the full wheel form so that frequent redressing is unnecessary.

The machine will accommodate gears up to eight inches in diameter and will grind up to four-inch maximum length of teeth. Pitch range is from a minimum of 50 diametral to a maximum of 8 diametral or 0.4 circular. Quantities of gears of 16 diametral pitch and finer can be ground simultaneously from the solid. Maximum helix angle of teeth is 45 degrees. Helical and spur gears of the same pitch can be ground with the same wheel without redressing.

Accuracy of the work depends greatly on the accuracy of the helical ribbed form on the grinding wheel which is produced initially by preformed Crushtrue dressing and then finished to extreme accuracy by diamond dressing.

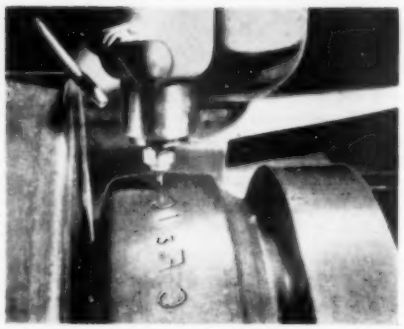
This American machine tool is the outgrowth of a similar machine made by the Coventry Gage & Tool Co. of Coventry, England, which Sheffield has redesigned and developed for the American market. Details and specifications are available in Catalog No. 140.

T-9-891

Roll Engraver

A tracer-controlled pantograph engraving machine has been announced by the George Gorton Machine Co., Racine, Wis. It successfully mills and engraves the surface of large rolls which have been heat treated to 50 Rockwell C.

Until this roll engraver was developed, rolls had been marked in various ways, including stamping and hand chiseling. Therefore, it is understandable that a ruggedly-built pantograph machine which is capable of precision engraving the necessary symbols in these rolls constitutes a substantial improvement in method and results.



The P-32 roll engraver is the smaller of two models available. It accommodates rolls up to 36 inches in diameter by 7½ feet long.

The machine consists of a large bed casting, strongly ribbed, which contains an accurate key way running the entire length of the bed in the center. This is used to position the two work holding brackets. On either side of this key way there is a T-slot for use in clamping the two U-shaped work holding brackets, one at each end of the roll shaft. These brackets have 1¾-inch openings to accommodate roll shafts of varying diameters and each upright has a vertical slot through which clamping bolts are inserted to position and clamp the two cross members which mount the roll shaft supporting rollers. A rugged elevating screw under each cross member is used to position the roll vertically and to provide positive support during use.

A heavily ribbed solid rail with a scraped dovetail way on top is bolted to the rear edge of the base. A two-dimensional pantograph mechanism is attached to and slides along this dovetail way from one end to the other of the rail. This movement is effected by a large hand wheel and a rack and pinion located under the rear edge of the rail. The pantograph is clamped in any position along the rail by means of a positive clamping lever.

Transverse, or cross movement of the pantograph to bring the cutter point over the axis of the roll is also on scraped dovetail ways. Saddle is then clamped in place by a clamping lever.

When mounting or removing rolls, the pantograph is moved to the extreme right on the rail extension where it is out of the way.

The pantograph on this machine is the standard Gorton P-32 two-dimensional Pantomill with a special saddle between the supporting rail and the pantograph mechanism. This pantograph is of extra heavy construction.

T-9-901

Wax-Type Oil

A wax-type cutting oil called Wax-Cut is designed for use in automatic screw machines, gear cutting machines, broaches, lathes, and other types of machine tools which use oil-type cutting fluids.

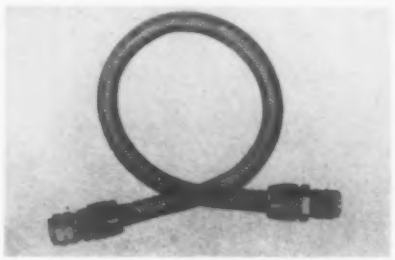
The reduction of heat when using Wax-Cut means less smoking and wasteful loss of cutting fluids through burning and atomization. The product is free of all chemically active additives such as chlorine and sulphur. It will not stain non ferrous metals nor damage machine bearings or gear mechanisms and may be used in machine tools using a universal lubricant.

For further information, write Industrial Products Department, S. C. Johnson & Son, Inc., 1525 Howe Street, Racine, Wis.

T-9-902

Plastic Tubing

Tygon flexible plastic tubing with a triple-wire, stainless steel outer braid has been made available by the U. S. Stoneware Co., Akron, Ohio. This form of Tygon tubing was developed to meet the demand for a chemically resistant, translucent, non-toxic, flexible tubing and hose for high-pressure applications.



With this braided stainless steel reinforcement, the tubing absorbs vibration more readily and does not crack, leak, or break under working pressures up to and including 300 psi. Because of the flexibility of this tubing, less footage is required than with rigid tubing, fewer fittings are necessary, and no special tools are required for installation. It also has the added advantage of being translucent, permitting visual inspection of flow and simplifying cleaning.

Tygon stainless steel braided tubing is stocked in two sizes, ¼-in. ID and ⅜-in. ID. It is available in six standard formulations and in running or fitted lengths. All fittings are stainless steel. The ¼-in. ID fittings can be field-applied. The ⅜-in. ID crimped fittings are factory applied. **T-9-911**

Copying Machine

Photo-exact, finished copies of any office record can now be made in less than a minute without developing, washing, fixing or drying. Copyfix, is the name of this development which makes positive copies of any record, regardless of type or color, from originals up to 14 in. wide in any length.

Small, light and compact, Copyfix takes not much more space than dictating equipment. No special installation is required, the machine operates after being plugged into any electrical outlet. No darkroom is needed.

The record to be copied is placed face to face with a sheet of Copyfix negative paper on the printer and exposed. They are then removed from the printer and the exposed negative paper with a sheet of positive Copyfix paper is placed in the Copyfix. In about ten seconds, the two sheets will emerge from the rear slot of the machine. Peel them apart and a positive copy is ready for immediate use. For further information write to Remington Rand Inc., 315 Fourth Ave., N. Y.

T-9-912

Warehouse Truck

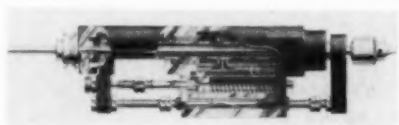
This heavy duty truck is designed for use where heavy loads are to be moved and rubber-tired wheels are desired. Its overall measurements are 54 in. long by 28 in. wide by 42 in. high at

the handle. Platform top is 14 in. off the floor and is built of $\frac{3}{16}$-in. plate welded to four 3-in. supporting channels running lengthwise. The handle is $1\frac{1}{4}$-in. pipe welded to the supporting frame.

Four roller-bearing, rubber-tired wheels are used, two rigid ones are 12 x 3 in. and the two at the handle are swivel casters 8 x $2\frac{1}{2}$ in. Made by Palmer-Shile Co., 12621 Mansfield, Detroit 27. **T-9-921**

Air Drill Unit

The Gurmendi air drill unit contains a hydraulic monitor which takes the sponginess out of air, resulting in quick approach to the work, positive adjustable rate through the work, with no danger of break through, and rapid return.



The unit has positive stop adjustments on both forward and return strokes. Stroke is a full 2 in. with controlled feed of $1\frac{1}{4}$ in. Control of the feeding rate is taken over at any desired point in the spindle travel by the hydraulic monitor, giving a fully adjustable feed rate.

All bearing surfaces are standard items. The spline pulley is mounted rigidly in the housing with precision ball bearings, which eliminates shaft loads. The hydraulic monitor is honed steel, cast integrally with the aluminum body. Heavy Oilite bearings are used on the piston rod. The spindle is equipped with a $\frac{1}{4}$ in. capacity Jacobs chuck.

The base is machined accurately to the alignment of the spindle, facilitating set-ups on brackets or fixtures. The design allows a set-up of two or more drill units as close as two inches between centers. Made by Alkon Products Corp., 698 East 142nd St., New York 54. **T-9-922**

Abrasive Unit

Cutting by means of a high-velocity stream of gas-propelled abrasive particles, the S. S. White industrial airbrasive unit provides a fast, accurate method of doing a number of high precision operations, including controlled removal of metallized films from glass and ceramics, drilling thin sections of hard-to-work materials, cutting extremely hard or brittle materials, etching, light deburring and polishing. The unit is expected to find applications in jewelry manufacturing and in the electronics, glass, ceramics and precision metalworking industries.

In operation, the airbrasive units directs a gas-propelled abrasive stream against the work surface through a sintered tungsten carbide nozzle. As it leaves the nozzle, the stream travels at approximately 1100 feet per second and is only 0.018 in. in diameter. As a result, fast and accurate cuts can be made.

The unit has practically no effect on resilient or soft materials, such as rubber, cloth and certain types of plastics. Likewise, it will not damage skin tissue, should the operator accidentally put his hand in front of the abrasive stream. This selective cutting effect has been found useful in removing metallized films coated on a relatively soft base.

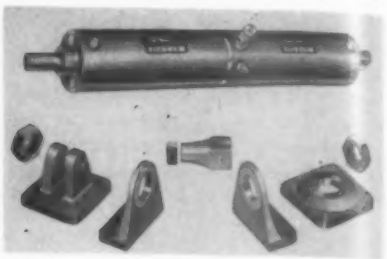
Normally, a specially processed aluminum oxide powder is used as the abrasive. For certain applications which require a lighter abrasive, a classified Dolomite—a mixture of calcium and magnesium carbonates—can also be supplied. Standard commercial grades of abrasive are not suitable.

Any dry inert gas can be used as the propellant. Carbon dioxide is generally preferred, however, because of its ready availability.

Details of the unit are contained in bulletin 5205 which can be obtained from the S. S. White Industrial Div., 10 East 40th St., New York 16. **T-9-931**

Air Hydraulic Cylinder

Modernair Corp. announces its latest development in the field of industrial pressure operated devices, namely an air hydraulic cylinder. Two bore sizes are presently available as standard—2 and 3-in. Other sizes on special order.



This air hydraulic cylinder features interchangeable mounting brackets and is available in standard 2- and 3-in. bore size. Standard shop airline pressure is utilized to actuate the cylinder, while the built-in hydraulic system furnishes positive regulation of forward or reverse stroke movement by adjustment of the speed control.

The cylinder is suitable for powering tools or work in machining operations, to permit rapid traverse (if skip feed by-pass is used), finely controlled movement during work operation, and fast reverse action. Flush exterior permits installation in restricted space. Made by Modernair Corp., San Leandro, Calif. **T-9-941**

Thread Wire Gage

A three-wire thread gage has been developed that promises time-saving benefits in measuring pitch diameter. The Scully thread gage employs the standard wire method of measurement, but simplifies the mechanical operations involved. With this gage, there is no lost time fumbling with loose wires. One hand holds and locates the three wires comfortably and quickly. Each gage is calibrated and uses best wire size for one pitch. It measures any diameter up to 2½ in. Tolerance is plus 0.0000, minus 0.0002 in. It is available in the following American Standard Pitch: 32, 28, 27, 24, 20, 18, 16, 14, 13, 12, 11, 10 threads per inch.

For information, write Scully Machine Co., Bridgeport, Conn. **T-9-942**

Punch Press Stop

Pressstop, an electro-mechanical punch press stop, has been announced by the Brinnell Co., Simsbury, Conn. Pressstop holds down the treadle or hand lever of a punch press electrically, and releases it instantly when the operator pushes a stop button. When the operator engages the mechanical clutch, a solenoid is energized, automaticallly engaging a holding latch that holds down treadle or lever for continuous press operation. A stop button de-energizes the solenoid, releases the holding latch and allows the clutch to disengage. A special cut-out switch permits single stroke operation. Special protective features are: solenoid is continuously energized while press is operating; in event of power failure solenoid is de-energized and press stops automatically. Clutch must be engaged manually before press can be re-started.

T-9-951

Quick Change Chuck

Built especially for use in extremely precise work beyond the limits of ordinary chucks, the German-made May speed chuck provides exceptionally rapid one-hand tool changes even at high spindle speeds, simplicity of use and greater operator safety.

Diametrical clearance in the chuck is kept to a minimum to assure the highest degree of precision. Conical bearing surface of the hasp casing head eliminates end play and thus greatly reduces tool breakage or work spoilage.

Tool changes can be made with safety while the spindle is rotating, since the operator grips only the loose knurled collar of the adapter with no need for touching drills or other rotating parts. Adapters can be changed safely, in a few seconds' time, at spindle speeds as high as 1800 rpm.

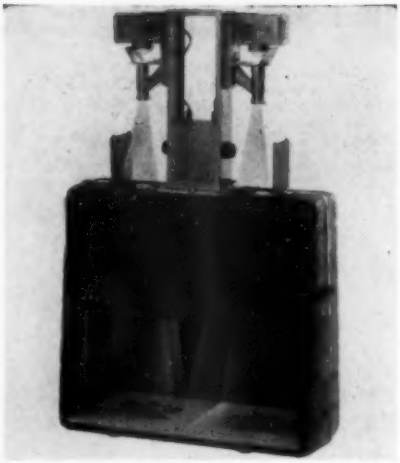
On the machine, the speed chuck is always open for the insertion of the adapter in which the drill has previously been locked by means of a knurled drift pin. The operator holds the adapter by the loose collar, which does not rotate at any time. As the adapter is inserted into the revolving chuck, adapter body also begins to revolve, and keys inside chuck seat themselves on keyways on adapter.

Tools can be removed from adapters without the need for using the conventional drift and hammer. Bumping the end of the knurled drift pin against a metal base immediately loosens the tapered shank of the tool.

May speed chucks are available with Morse Tapers Nos. 2 and 3. Literature may be obtained from Kurt Orban Co., 205 East 42nd St., New York 17.

T-9-952

Surface Comparator



Greater flexibility in use, increased portability and more pleasing appearance are the features of the Faxfilm surface comparator, Model BL-122, now being introduced by The Brush Development Co., Cleveland 14. Faxfilm is the method of surface study in which a clear plastic replica of a surface is made in about a minute and projected in a microprojector to show minute details of surface condition with marked three-dimensional effect.

The surface comparator provides comparison projection of two Faxfilm replicas at 30-diameter magnification. Its principal uses include comparison of work specimens with standard finishes in surface roughness inspection, the comparison of finishes obtained in machinability studies, and comparisons of surface changes in wear and life tests.

The comparator is 25 x 12 in. at the base and 22½ in. high. Including an accessory and file case, carried in the base of the unit, total weight is less than thirty pounds. Projectors use Wollensak 1-in. f:1.9 projection lenses.

T-9-961

Bending Machine

A hand-operated bending machine which bends up to one-in. diameter cold finished steel bar and 1¼-in. tubing or their equivalents has been added to the Di-Acro line by O'Neil-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn.

Designated Di-Acro bender No. 4, it is designed for heavy bending operations where production does not warrant a power-driven machine. It offers a radius bending range from 0 to 12-in.

A feature of the machine is a built-in ratchet mechanism which can be engaged or disengaged by the operator, depending upon the size of the material being formed. Engaging the ratchet mechanism increases the material capacity of the bender, larger and heavier size material can be bent, and multiplies the operator's effort by approximately four times.

By disengaging the ratchet, operating the bender in direct drive, the operator can step up the production of lighter materials.

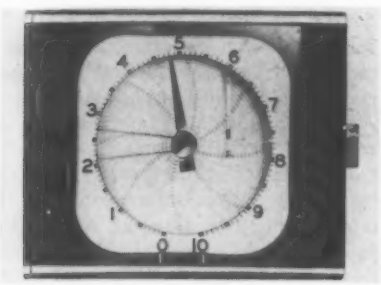
The bender can be quickly changed over from one forming operation to another. It provides a method of producing one or many, simple or complicated parts without the cost of dies.

A special stand is available for the bender as is a complete line of accessories for bending tubing, angle, channel, extrusions, mouldings, strip stock, bus bars, round or square rods and other solid, ductile materials.

T-9-962

Round Chart Recorder

The Bristol Co., Waterbury 20, Conn., announces the addition of round-chart recorders and automatic controllers to its line of electronic Dynamaster potentiometers and bridge instruments. The round-chart models are accurate, high-speed, continuous-balance, null-type electronic instruments which can be used to measure any variable that can be translated into an electrical quantity such as d-c current, d-c voltage, capacitance or resistance. Typical sensing elements that can be used with the instruments include thermocouples, radiation detecting units, resistance thermometer bulbs, pH amplifiers, tachometer magnetos, strain gages, smoke density detectors, thermal converters for power measurements, beta ray gages, and many others.



The measured variable is simultaneously recorded on a 12-in. diameter chart and indicated on a large circular scale which is legible at a distance. Models are offered for full-scale pen travel in 7 seconds, 3 seconds, 1½ seconds, or ⅔ second, and with a wide variety of ranges. Controlling models with all types of air control and electric control action are also available.

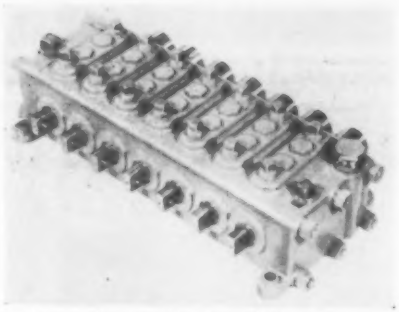
The unit universal construction of the recorder permits complete interchangeability of components. The recording mechanism is on the front of a hinged aluminum alloy panel, which can be swung out to gain access to the electronic components. The instruments are housed in a moisture-, fume-, and dust-proof case suitable for wall, flush-panel, or front-of-panel mounting.

T-9-971

Stack Valve

A larger, ¾-in. multiple section stack valve has been developed by the Hydraulic Division of Sundstrand Machine Tool Co., Rockford, Ill.

The ¾-in. valve is designed for series operation, permitting any number of devices to be actuated simultaneously under full or varying load, provided the total load does not exceed the relief valve setting. Thus, on a grader, for example, it is possible to lift both ends of the blade simultaneously. This permits continuous, rather than intermittent operation.



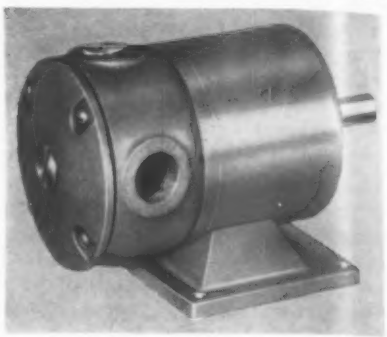
From the standpoint of the operator, the inclusion of a check valve in the body of each section is a guarantee of greater safety. Positive starting and stopping under load is assured. Loads cannot be dropped or shifted as their direction is changed since positive cylinder movement is always maintained and no momentary reversal of the cylinder is possible as the stem is shifted.

The S-25 valve incorporates pressure sealing by using O ring seals between sections. This not only assures leak-proof construction, but permits addition of sections at a later date if additional hydraulically operated attachments are desired.

A new bulletin, No. 3104, has been prepared illustrating and describing the ½-in. and ¾-in. valves. This is complete with necessary data, drawings, and typical circuits. Bulletin 3104 is available from the company. **T-9-972**

Indicating Contactor

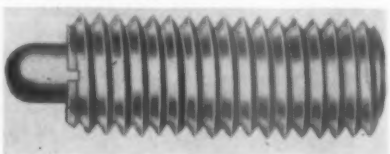
This direction and zero indicating contactor operates at speeds as low as 4 rpm and as high as 5000 rpm in temperatures between —20 deg F and + 250 deg F. Ratings are from ½ to 10 amps at 110 volts ac. Of all metal construction, the small, compact unit



can be mounted in any position. It is a self-lubricating, hydraulically driven mechanism, with magnetically actuated contacts. Applications include indication of shaft rotation and direction of rotation, prevention of stationary controls from operating while parts are revolving, controls on conveyors, etc. It is adaptable as a plugging switch. Adjustable models are available for cut-in and cut-out speeds to 100 rpm. Made by the Winterburn Mfg. Co., P. O. Box 386, Putnam, Conn. **T-9-981**

Spring Plunger

A series of high-speed spring plungers with lighter spring pressures than the standard plungers, developed specially for high-speed automatic punch presses and other machine tools, has been announced.



Silvertip spring plungers enable the operator to position and release workpieces easier and faster without spring failure due to crystallization. Springs supplied with these plungers have been specially formulated and designed for long life, and the entire unit is constructed of the highest quality materials. Plunger end is rust-resistant and case hardened and telescopes completely into the plunger body. Spring pressures are uniform and constant. The plunger body has national coarse Class No. 1 thread to prevent freezing in the fixture.

The Silvertip plungers range in length from ½ to 2¼ in. with spring pressures from 1 to 6 lbs.

For further information, write to the Vlier Mfg. Co., 4552 Beverly Blvd., Los Angeles 4. **T-9-982**

Squaring Shears

A series of ¼-in. power squaring shears in 4-, 6-, 8-, and 10-foot cutting lengths has been announced by Wysong and Miles Co., Greensboro, N. C.

Construction is from massive, Hi-tensile castings. Back gage is ball-bearing, precision, adjustable to 0.0078 (1/128th) in. by front-operated hand-wheel. Hold-down action is by roller and cam action. Individual compression springs in each hold-down foot compensate for varying thicknesses in metal being sheared. Clutch is jaw-type.

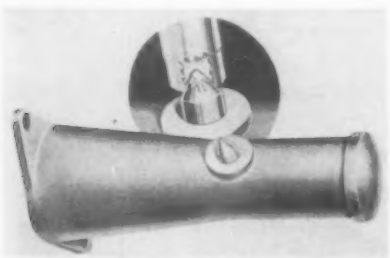
A full-length open space between hold-down and knife-bar makes the cutting line clearly visible. The operator can easily cut to a scribed line. To insure accurate shearing, surfaces where end frames and bed join are hand-scraped for perfect bearing. In assembly, bed is squared in all directions.

Knife bar is a massive, well-ribbed, one-piece casting. Bed is one-piece casting with cored pockets for added strength. To give accurate measure from cutting line, adjustable stainless steel scales are embedded in various positions on the surface of the table.

T-9-991

Center Lubricator

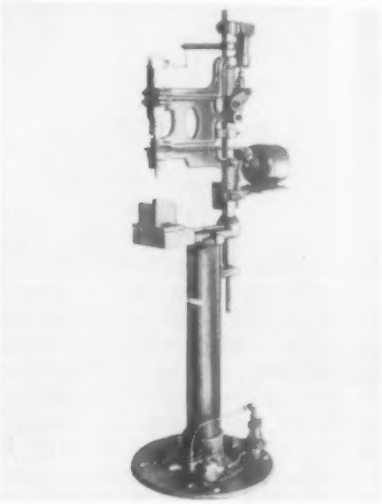
The H. K. Tool Co. of Waukesha, Wis. announces a center lobe dispenser for the lubrication of centers on lathes and grinders. The unit is a sealed oil dispenser which can be mounted on the workbench or machine and becomes a permanent fixture.



There is a pinhole channel down the heart of the center of the dispenser direct to the lubricant storage well. This center is anchored firmly but will depress and release lubricant in a single, quick movement as the operator places added pressure on the work or mandrel while holding the work with both hands. The lubricant is sealed in and flushes outward, keeping the center free from borings and chips. **T-9-992**

Pneumatic Riveter

Lemert Engineering Co., Plymouth, Ind., announces the addition of a new model to its line of Airflex pneumatic riveters. Incorporating a spindle designed to minimize impact noise, the model features a rotating hammer, blows of which can be carefully regulated as to force, rapidity, and duration, depending on the job.



Airflex riveters are semi-automatic. Equipped with an air-timing valve, the riveter goes through a cycle of operation in response to the touch of a foot pedal. The time valve may be set for a series of impacts ranging in duration from 5/10 second to any designated length of time.

An adjustable nose is a feature of Airflex riveters. The force of the blow and the hammering speed may be regulated independently of each other. Ranges are 5 to 80 lb per square inch and from 6,000 to 16,000 strokes per minute.

The hammer impact is controlled by altering the air pressure and by lengthening or shortening the gap between the piston head and peening spindle. **T-9-1001**

Ceramic Welding Nozzles

Tru-Ohm Products, Div. of Model Engineering & Mfg., Inc., 2800 North Milwaukee Ave., Chicago 18, announces ceramic welding nozzles.

Deep section welds are easily accomplished using these nozzles. The flow of gas is more directional with less volume, without increasing the arc-clamping characteristics, with savings in shielding gas costs.

The light metal adapter dissipates welding heats readily, thus affording torch protection.

Nozzle orifices are 1/4 and 5/16 in., length 3 in. Nozzles are rated at 200 amp dc, intermittent duty and 150 amp dc, constant duty. **T-9-1002**

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-9-168-3	Ace Drill Bushing Co.	1101-2	Larger stocks, faster service,—more reasons to SPECIFY ACE.
A-9-180	Allegheny Ludlum Steel Corp.		High-speed-steel tool bits, ready-made—convenience, economy, dependability.
A-9-181	Allied Products Corp.		Efficient and economical production. Free catalog.
A-9-154	American Broach & Machine Co.	300	Accuracy and power combination explained in circular.
A-9-92-1	American Wheelabrator & Equipment Corp.	23	Easy starting, convenient operation and speed combination with new Liquamatic.
A-9-143	Ampco Metal, Inc.		Enjoy higher production—freedom from trouble.
A-9-111	F. E. Anderson Oil Co.		Longer life and more efficiency for chasers and taps with Lusol.
A-9-90	Armstrong Bros. Tool Co.	S-48	New catalog describes tooling system, assuring maximum production and higher profits.
A-9-239	The Atrax Co.		Complete catalog describes Quality Engineered burs, reamers, end mills, etc.
A-9-148-1	Barksdale Valves	2 C-C	Bulletin explains how Crescent valves save you money.
A-9-170	Behr-Manning Corp.		Blueprints for Production gives actual case studies of cost-cutting polishing operations.
A-9-28	Bellows Co.	CL-30	Free booklet gives new conception of fast, precision operations.
A-9-109	Besly-Welles Corp.		Unsurpassed accuracy at all vital points with Besly taps described in free manuals.
A-9-204	Carpenter Steel Co.		Tool Steel Manual gives help in steel selection, heat-treating, and other cost-reducing methods.
A-9-168-4	Chicago Tool & Engineering Co.	10	"Palmgren" rotary, index, milling-table advantages described in circular.
A-9-158	Cincinnati Milling Machine Co.	M-1759	Bulletin gives complete description of Hydro-forming—tooling details, operation, etc.
A-9-127	Cleveland Tapping Machine Co.	T-18	Free catalog suggests an end to tapping problems.
A-9-227	Crucible Steel Co. of America		Crucible Tool Steel Selecter—a twist of the dial gives the tool steel for your application.
A-9-217	The Cushman Chuck Co.	PO-64	Cushman Power Chuck Catalog contains complete data on all lines.
A-9-112-1	Detroit Stamping Co.		De-Sta-Co. catalog describes available stationary and portable toggle clamps.
A-9-147	The DoAll Co.		Complete information given in grinder catalog on DoAll grinders for toolroom and production work.
A-9-126	Erickson Tools Division	J	Production problems? Catalog gives solution.
A-9-164-1	Galland-Henning Mfg. Co.	SW-1	Refer to Sweet's File for Product Designers.
A-9-19	Gisholt Machine Co.		Simplimatic Catalog is ready, complete with the information and specifications wanted. Pictures and job facts.
A-9-132	Golconda Corp.		Circular gives full details and price on Sta-Sharp Diamond tools for every purpose.
A-9-118	Graham-Mintel Instrument Co.		Free Micro-Ac bulletin shows typical applications—measures in millionths.
A-9-225	Greenlee Bros. & Co.		Concerned with automatic screw-machine production. Free monthly issues contain practical and informative articles.
A-9-235-1	Grobet File Co. of America, Inc.	HC1	Catalog sheet describes Grobet Chatterless Countersinks—six staggered cutting edges.
A-9-169	Handy & Harman	20	Free bulletin stresses strength and economy of Easy-Flo brazing.
A-9-23	Hannifin Corp.	231	2-way, 3-way, 4-way pilot, master and pilot-master valves explained in free bulletin.
A-9-3	Hardinge Bros., Inc.	8	Accuracy, durability, economy assured with use of company's chucks and collets.
A-9-89	John Hassall, Inc.		Hassall's decimal-equivalent wall chart—a constant reminder of a good source for cold-headed parts.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

THE TOOL ENGINEER, DETROIT 21, MICH.

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-9-130	Henan-Crane Corp.		Free folders give right solution for problems and information about HC engineering service.
A-9-97	Howe & Fant, Inc.		Lign-o-matic turrets make more holes per hour—per dollar. Free literature.
A-9-219	Illinois Tool Works		Specific engineering of gear-shape cutters can be important in cost picture.
A-9-128	B. Jahn Mfg. Co.		Error, chance, uncertainty eliminated by positive B. Jahn method.
A-9-133	Kempsmith Machine Co.	127	Bulletin emphasizes accuracy, rigidity, low initial cost and upkeep.
A-9-16	Lapointe Machine Tool Co.	5	Mass production without broaching.
A-9-229	Mechanite Metal Corp.	36	20-page pump bulletin gives complete details on pump applications.
A-9-172	Metal Carbides Corp.	50-G	Centerless Blades outlast and out perform all others—on some jobs by as much as 50 times.
A-9-215	Micromatic Hone Corp.		Is your problem production, precision, or costs? Cross Hatch describes Microhoning Machines.
A-9-241	Miller Motor Co.	A-105 H-104	No broken castings; no scratch damage to piston rods, bushings and seals.
A-9-151	National Broach & Machine Co.	C-51-6	Bulletin gives detailed information and specifications on locating and evaluating gear errors.
A-9-92-2	Newcomer Products, Inc.	108	Catalog tells why S-6 Carbide is different and successful.
A-9-13	Norton Co.	189	#20 cutter and tool grinder,—versatile, rapid, economical.
A-9-163	Norton Co.	2006	Handy illustrated booklet gives essential facts and cylindrical and centerless grinding.
A-9-186-1	Oakite Products, Inc.		Metal-cleaning jobs easier and cheaper. Described in 24-page illustrated booklet.
A-9-162	Parker-Kalon Corporation		A new assembly planning aid available in the PK Engineering Standards book.
A-9-228-1	J. A. Richards Co.	TE-5	Illustrated folder explains efficient production without special tooling.
A-9-171	Scully-Jones & Co.	2-50	Bulletin shows complete line and large selection of SJ arbors, collets and adapters.
A-9-183	The Springfield Machine Tool Co.	184	Contouring lathe gives positive, smooth, continuous backlash-free hydraulic movement. Free bulletin.
A-9-108	The Standard Electrical Tool Co.	TW	One step from rough to finish grind; no spray, no splash.
A-9-5	Standard Gage Co., Inc	C	Fast operation, easy size conversion shown in new catalog.
A-9-208-1	Standard Shop Equipment Co.	A-85	No time wasted when using Standardized appliances—designed to fit T-slots.
A-9-191	D. A. Stuart Oil Co.		More than a "Coolant" is needed. Free Dilut-o-graph shows ease and speed in diluting fluids.
A-9-203	Super Tool Co.	50	Complete range of types and sizes simplifies your tooling job.
A-9-245-2	Surface Checking Gage Co.	F	Control of surface quality, stepped-up production. Increased efficiency realized through Surf-check.
A-9-161	Turchan Follower Machine Co.		New catalog—more jobs, faster, better with company's hydraulic duplicator.
A-9-211	U. S. Tool Co., Inc.	15	Bulletin shows how to reduce costs and eliminate secondary operations.
A-9-248	Wales-Strippit Corp.	BL N	Fully illustrated, functionally colored catalogs offer story on faster, more economical production technique.
A-9-123	Wendt-Sonis		Chip Breaker Chart contains illustrations of chip-breakers, grinding instructions and recommendations for their use.
A-9-112-2	Wilton Tool Mfg. Co.	101E	POWRARM work positioners cut costs, increase productivity.
A-9-93	Zagar Tool, Inc.	E-9	Manual furnishes information on the adaptation of Zagar Gearless Drillheads to any drill press.

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

FIRST CLASS
PERMIT NO. 10782
(Sec. 510, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER

ASTE Building

10700 Puritan Ave.

Detroit 21, Mich.

ATT: READER SERVICE DEPT.

USE THIS HANDY FORM

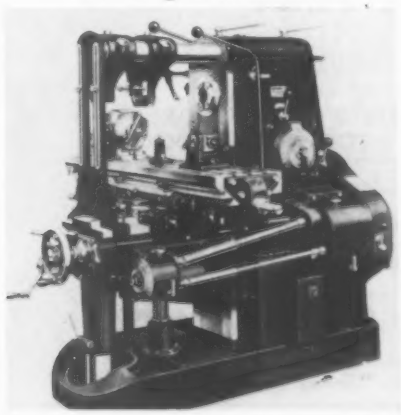
to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

Tapping Chuck

A finger-tip-control tapping chuck which brings extreme sensitivity and precise control of small taps in high volume production work has recently been introduced by the Commander Mfg. Co., 4225 W. Kinzie St., Chicago.

Designed for use with the Commander tapper, the chuck permits maximum use of the tapper's spring clutch drive and adjustable torque control features. In operation, the tapping head remains in fixed position, since actuation of the tap is entirely controlled by the operator's fingers on the finger-tip chuck. Employing a unique drive engaging collar, a $\frac{1}{8}$th turn of which engages or disengages the tap from the driving mechanism, the chuck permits the operator to feel the tap as it enters or leaves the work. Vertical movement of the tap to $\frac{3}{4}$ in. is controlled by the operator's finger tips. **T-9-1031**

Milling Machine

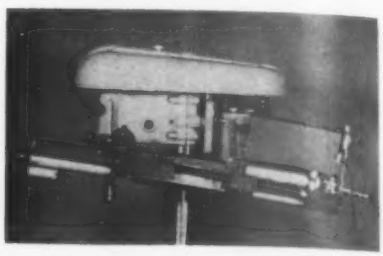


A line of Swedish milling machines has been announced by American Pullmax Co., Inc., 2455 North Sheffield Ave., Chicago 14, for sale in the United States. The machines, available in both horizontal and vertical types, are manufactured by the Koping Co.

Complete versatility is made possible through a broad group of accessories and adjustment controls that particularly suit the Koping milling machine for both toolroom work and production work. **T-9-1032**

Drill Press Feed

The Bellows Sensitorque drill press feed, manufactured by the Bellows Co., 230 West Market St., Akron 9, Ohio, is a new approach to the problems of drill breakage which are encountered in deep-hole drilling. The Sensitorque does not depend upon any predetermined timing cycles for its operation. By measuring the torque on the drill, it senses what is going on in the bottom of the hole and the drill is withdrawn only when the strain approaches the danger point. By eliminating needless withdrawals, while safeguarding the drill, the drill press feed greatly reduces production costs.



The Sensitorque drill press feed consists of a sensor cabinet mounted on a standard Bellows model DFE 2-540 drill press feed. The sensing unit does its work by the use of aircraft type relays. If the drill, even as small as 0.094 in. becomes clogged with chips, runs dry of coolant, hits a blowhole or seizes in any way, an electrical impulse is sent to the drill press feed which withdraws the drill and then immediately and rapidly returns it to working position. It will do this as often, and only as often, as necessary until the job is done. The amount of withdrawal is adjustable, all the way out of the hole, or as short a way as desired. By means of a rheostat, the unit can be set to react to a drill torque of a few inch-ounces up to the full spindle motor power. **T-9-1041**

Cold Cathode Tube

The development of a cold cathode triode tube applicable as a control for all types of industrial electronic equipment has been announced by Haledy Electronics Co., 57 William St., N.Y.

This tube, the Haledy TT-1, which contains an external electrode and can operate under any temperature conditions, eliminates the warm up time, stand-by currents and limited life of present hot tube electronic controls.

Circuits employing the Haledy TT-1 result in an amplification of 2½ million or more, and a grid current of less than 1 micro-ampere. Since the tube does not contain a filament, filament transformer, plate transformer or complex power supply, it offers simplified design possibilities. **T-9-1042**

Brake Motor

This built-in brake motor, available for use with Graham transmissions, provides for immediate stops required in indexing and positioning work. This feature plus the other features inherent in the Graham drive such as infinitely wide speed range with exact speed holding and ability to reset at a given speed, makes the unit well suited for applications requiring accuracy. These applications include metering and proportioning work and jobs where the speed of one part of a materials handling system must be synchronized with another part.

The transmission, in all sizes from 1/8 to 3 hp, is available with or without built-in reduction of worm or helical spur types. A wide range of controls, including micrometer, lever and remote electrical may be had. The complete assembly of transmission, built-in motor with or without brake, built-in reducer and control mounts with only four bolts. The transmission has built-in overload protection to prevent damage to the unit or to other parts of the power transmission system in case of a jam in the driven equipment.

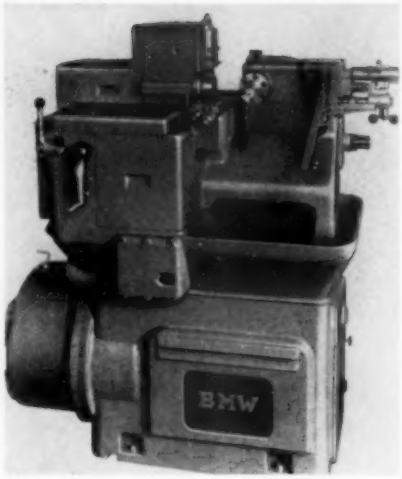
The new brake is a direct acting disk type of rugged design with fewer parts, smooth and instant action, cooler operation and no solenoid or mechanical linkages. Motor and brake are connected in parallel. Starting the motor simultaneously energizes the magnet coils. The magnet attracts the magnet armatures which are attached to the pressure plate, compressing the springs and releasing the pressure on the disks. Stopping the motor de-energizes the coils. Spring tension then forces the pressure plate back, applying firm, steady pressure to the disks, quickly stopping and holding the load.

T-9-1051

Automatic Screw Machine

Interchangeable cam assembly units that can be preselected and assembled for the next job, while one job is still being run reduce set-up and down-time on the German-built B M W single spindle automatic screw machine, which is distributed in the United States by Kurt Orban Co., Inc., 205 East 42nd St., New York 17.

The assembly unit not only includes cams for the longitudinal feed of the turret, front and rear cross slides, turret index, collet actuation and stock feeding but also, as standard equipment, trip dogs to change rotation of the work spindle. Both cams and trip dog disks are divided into 100 graduations and the drive rings are designed with 100 serrations to permit rapid and correct settings. Cams and trip dogs are positively locked in place to assure exact size control and accurate timing.



The short rigid work spindle is mounted in precision anti-friction bearings, belt-driven between bearings, and can be run up to 5800 rpm. The six-hole turret and the three cross slides are rigidly constructed and their guide ways are protected by chip guards. All slides have micrometer adjustment. Collets and cams are interchangeable with American-built equipment.

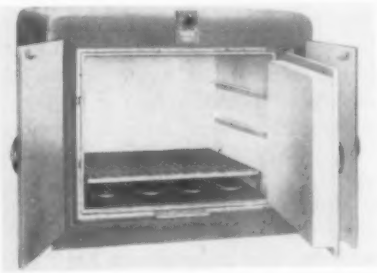
The driving mechanism and the cams are completely enclosed and separated from the tool and chip area, but are readily accessible through detachable guards. The hand-feed crank is automatically disengaged by a safety interlocking device when power feed is used.

Bar capacity is $\frac{7}{8}$ in. OD, with a maximum turning length of $1\frac{3}{4}$ in. Attachments are available for high-speed drilling, cross drilling, recess boring and slotting. **T-9-1061**

Portable Oven

A portable electric oven for high temperature processing called model HT-2 equipped with Inconel sheathed sealed tubular heating element for greater heating efficiency has been announced by Grieve-Hendry Co., Inc., 1101 N. Paulina St., Chicago 22.

The oven features a thermostat control with a temperature range of 300 to 1000 deg F.



Two or more of these ovens can be used in a group or bank since they are constructed to nest one on the other. Individual ovens in a group may be cut out or ovens can be operated at different temperatures.

Construction is heavy gage steel with a minimum of 4 in. of Fibreglas insulation. Double doors are provided for sealing in heat. Exterior is grey wrinkle finish. Drip pan, lower shelf, pilot light and outside reading thermometer are standard equipment. Additional shelves and automatic timer are available.

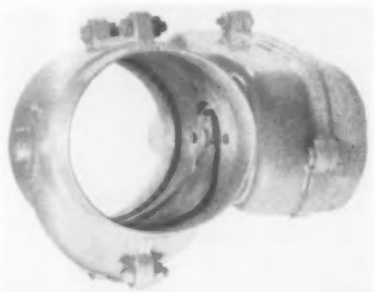
Size is 30 in. wide, 25 in. deep, 24 in. high outside. Inside dimensions are 22 in. wide, 18 in. deep, 16 in. high. Single-phase 220 volts is standard.

T-9-1062

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-106

Air Control Valve

Announcement of an automatic air control valve, for use with air suction systems and dust collectors on units such as metal grinding and polishing machines, wood jointers, planers, sanders, table saws, and other similar equipment, is made by the Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11.



The product is known as the Ventomatic air control valve (patent applied for) and can be fitted to any machine, pipe or installation within its scope. The valve opens and closes automatically as the machine is turned on and off. This prevents the continual exhausting of warm air from the room when the machine is not operating, and effects heating economies.

Improvement of efficiency in the entire suction system results from concentrating suction only on those machines that are actually operating. When the valve is open there is no obstruction in the air passage, eliminating the possibility of catching chips, dust, lint or shaving threads. The operation of the valve is mechanically controlled by a solenoid, and is in no way affected by the air stream.

Sizes of Ventomatic valves are available to fit 3-, 4-, 5-, 6-, 7-, and 8-in. ducts. **T-9-1071**

Metal Cleaning Solvent

Wayne Chemical Products Co., Detroit 17, announces Kemisol A, a chemical solvent for cleaning parts. The solvent is claimed to remove all traces of oil and grease from metal parts and when mixed in a solution from 0.5 to 1 percent with water at approximately 180 deg F, it offers a thin solution which can be used in almost all methods utilized for cleaning metal parts.

Kemisol A is neutral, odorless, nontoxic, noninflammable, and harmless to human skin. It is noncorrosive to aluminum, brass, copper, and most other nonferrous metals. **T-9-1072**

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

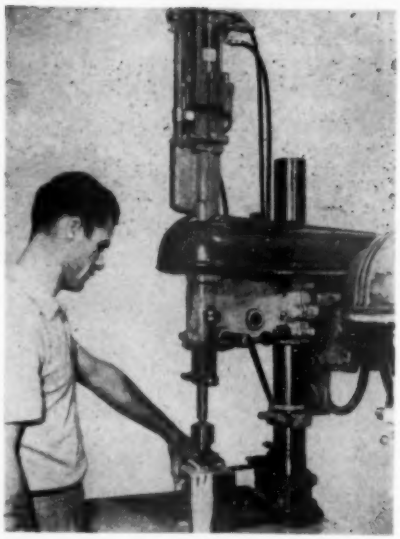
Deep Hole Drilling Unit

An automatic deep hole drilling unit, using the step-by-step feeding principle, is being introduced by The General Pacific and The General Detroit Corps.

The unit can be readily installed on most drill presses and is mounted above the spindle so that it does not crowd aisles.

In operation, the deep hole drilling unit begins its cycle by a rapid approach to the work, stopping about 1/32-in. above it. The second cycle feeds the drill into the work at an infinitely variable drill feed speed and to a depth of step varying from 1/32 to 5/8 in.

The next cycle is an automatic rapid retraction from the work to prevent chips from falling off the drill and dropping back into the hole. This also allows the coolant to enter the partially drilled hole. The drill approaches the work again, stops just before reaching it, then advances into the feed cycle repeating this until the predetermined depth of the hole has been reached when the drill withdraws from the hole and the machine shuts itself off.

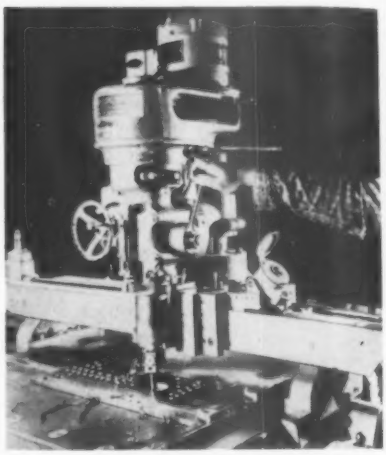


The unit may also be used as a conventional drill feed unit through a simple change-over adjustment or, if desired, it may be manually operated.

For information write The General Pacific Corp., 1501 East Washington Blvd., Los Angeles, or The General Detroit Corp., 2200 East Jefferson, Detroit. T-9-1081

Drilling Machine

A Wales deluxe model drilling machine for boring plus precision layout, drilling and reaming of holes has been announced by the Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y. This machine is equipped with a heavy-duty boring head and tooling that permits the boring of holes up to 5 in. in diameter.



The precision-built boring head with anti-friction bearings is equipped with an adjustable guide support that is moved down close to the top of the work for precision accuracy during drilling and reaming operations. Extra large bearing area on the boring head assembly base assures travel at exactly 90 deg on two accurately ground ways across solid bridge. The work is securely clamped to the long slide rail which moves in the hand-scraped ways and locates the work under the boring head. Full-sized table provides complete support for the work. Easier movement of the work is provided by anti-friction ball inserts located over the entire table area.

Two speed gearing, controlled by handwheels, provides rapid traverse for rough positioning and two built-in Scan-A-Scales zero-in the work to tolerances as close as one ten thousandth of an inch. T-9-1082

Bench-Type Furnace

The Cooley Electric Mfg. Corp., 905 Daly St., Indianapolis, Ind., announces an addition to its line of heat-treating furnaces and ovens, the VK-7 bench model with chamber dimensions of 10 x 6 x 18 in.

The furnace has heating elements of 6.5-kw capacity, at 220v single-phase, on all four sides of the chamber and in the door. This provides even heat distribution and close temperature uniformity. The elements are of embedded design which protects the element wire against atmospheric attacks and mechanical breakage. Renewal of elements can be made without dismantling the furnace.

The VK-7 furnace includes a fully wired and integrally mounted control panel carrying a controlling pyrometer, fused line switch, and instrument fuses.

T-9-1091

Small Parts Tumbler

Tumb-L-Matic, Inc., 4510 Bullard Avenue, N.Y., announces a tumbling barrel having individual pockets for tumbling from 2 to 6 items at a time. The Pocket Tumbler is recommended for deburring, precision finishing and polishing small metal and plastic parts.

The Pocket Tumbler comprises a rotating container, or frame, into which the pockets fit. Both the pockets and the frame are hexagon-shaped. The frame is enclosed on five sides during tumbling to hold the pockets in. One side of the frame opens to permit pockets to be inserted and removed.

Pockets are equipped with handles for ease of handling. They open on the side adjacent to the handle. By having an extra supply of pockets, loading and unloading can be accomplished while other pockets are being tumbled and a near continuous batch operation can be achieved. Tumblers are available with frames for handing from 2 to 6 pockets. Pockets range from 12 to 16 inches in diameter.

T-9-1092

Sheave Bushing

A Magic-Grip bushing has been announced by Allis-Chalmers Mfg. Co. for its stationary-control, wide-range varipitch sheave. The bushing makes possible quick and easy installation or removal of the sheave and permits mounting it on the shaft so that the adjusting control mechanism is either toward the motor bearing or away from it.

The bushing as used in the varipitch sheave consists of two split-tapered sheaves, one within the other. When drawn together with the locking screw, the bushing sleeve is contracted on the shaft and the outer sheave sleeve is expanded against the disks simultaneously to effectively lock the entire mechanism with all working clearances eliminated.

All torque is transmitted by keys in the two sleeves so that stresses due to starting, stopping or sudden overloads will not affect the sheave setting in any way. Spacing of the disks to produce different pitch diameters is accomplished with the adjusting screw while the locking screw is in loosened position.

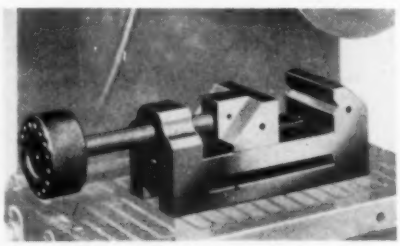
Design of the bushing permits the sheave to be installed on the motor shaft with the adjusting screws either away from or toward the motor bearing.

T-9-1101

Gage Vise

An accurate vise, exact to within 0.0003 in. on five surfaces, is available from Erickson Tools Div., Erickson Steel Co., Hamilton Ave., Cleveland 14.

It was developed as an improved means of rigid, accurate clamping for machining operations in both production and toolroom applications. A series



of accurate operations can be performed without once removing the work from the vise. The accuracy of the vise surfaces also saves most of the time usually spent in checking as work progresses.

The range of adaptability of the gage vise is large when it is used in combination with a sine plate.

The gage vises are made of high grade tool steel, properly hardened and accurately ground throughout. The jaw opening is 2⅝ in. and the body dimensions are 2⅜ in. square by 6 in. long. Total weight is 7½ pounds. **T-9-1102**

Battery Charge Indicator

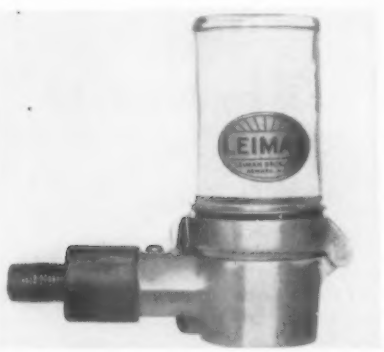
To help obtain greater efficiency and maximum economy with industrial truck batteries, Gould-National Batteries, Inc., Trenton 7, N. J. announces an improved charge indicator.

The instrument can be easily mounted so that the operator can see the dial at all times, thus giving him instantaneous readings of the state of battery charge while his truck is operating. An easy-to-read, three-colored dial indicates whether the battery is full, ½, empty, or in danger. Changing batteries as soon as they register empty prevents repeated overdischarge which shortens battery life.

The indicator, a Wheatstone bridge type instrument, is readily adjustable for 3, 6, 12, 15, 18, and 24-cell batteries; a series of resistors and taps permits the desired adjustment. It is completely enclosed in a metal case finished in black crackle enamel. The meter is balanced to read accurately regardless of its mounting or the truck's position. A toggle switch disconnects the indicator from the battery during charge. **T-9-1111**

Automatic Oiler

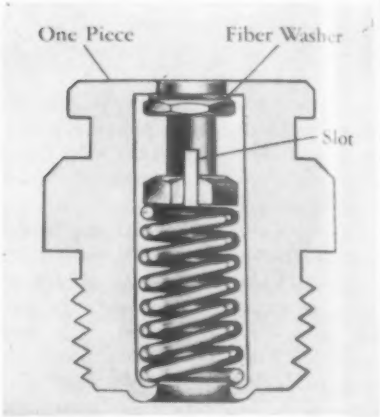
Developed to automatically feed measured amounts of oil to Leiman air pumps, the E-113 oiler provides adequate lubrication of wings and vanes, yet delivered air is virtually oil-free for printing and other operations requiring extremely low oil vapor content.



This automatic oiler replaces manual oilers and feeds any oil from SAE 10 to SAE 70. Rate of feed is quickly adjusted from 1 drop in 4 minutes to 4 drops in 1 minute. A transparent visual reservoir, hinged for easy re-filling, holds 3 ounces and lasts for days. It has no moving parts and feeds only when pump is running. It is actuated by a draft of air passing through it, and therefore can be used on a vacuum pump or on inlet of a pressure pump. A heat insulator prevents heat of the pump from warming and thinning oil in glass reservoir. Manufactured by Leiman Bros., Inc., 146 Christie St., Newark 5, N. J. **T-9-1112**

Grease Fitting

A Universal giant buttonhead grease fitting with one-piece construction is now being manufactured by Universal Lubricating Systems, Inc., Oakmont, Pa., for use on all heavy industrial machinery.



Employing a design new to the field, the fitting is built to provide maximum grease flow. It prevents the leaking possible with conventional two-piece buttonhead fittings which can be separated by extreme pressure or jolting.

One-piece construction imparts stronger, longer-wearing, abuse-resisting qualities, according to Universal tests. It also features a strong steel inner-spring which combines with a fiber sealing washer to prevent grease leak-back and is available in regular sizes. **T-9-1121**

Casting Repair Kit

Casting defects can now be repaired on the spot with the Metasealer Kit, recently introduced by the American Metaseal Corp., 607 65th St., West New York, N. J.

This kit contains materials, tools and supplies needed to repair defects in ferrous or nonferrous castings including pinholes, blowholes, sand holes, machining cuts, cracks, chips, flaws and surface irregularities.

The kit uses Metasealer plastic impregnant, a thermosetting plastic that seals casting flaws permanently, won't shrink or corrode, and can be machined or finished with paint, lacquer or enamel. It is resistant to all known solvents and commercial solutions and contains 100 percent solids.

In addition to the Metaseal plastic, the kit also contains additives, metal powders for metal matching, cups, tools and cleaning materials for the job. No training is required to use the Metasealer kit and full instructions are included. **T-9-1122**

Optical Flats

Two optical flats of unusual size have now been made available by The DoAll Co., Des Plaines, Ill. One is an exceptionally large optical flat, 10 in. in diameter, which affords adequate area for checking the flatness, size and parallelism of large pieces. The small flat is one in. in diameter and will be found useful for checking tiny surfaces such as the anvil of a micrometer or the ends of precision studs.

In spite of the appreciable size of the 10-in. flat it is available in the same accuracies as the one-in. flat. Several accuracies are available. In terms of deviation from absolute flatness these accuracies are as follows: one millionth (0.000001 in.), two millionths (0.000002 in.), and five millionths (0.000005 in. Each flat is marked with the exact accuracy in millionths

of an inch and this accuracy is maintained the full width of the flat.

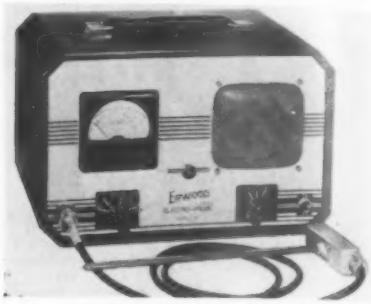
The flats which may be obtained with one or both surfaces lapped to the stated accuracy, are manufactured of pure, fused Brazilian quartz, selected for clarity and having minimum thermal expansion. All edges are smoothly ground and beveled and the sides are wrapped in a black band. Arrows on this band indicate the measuring surface or surfaces. **T-9-1131**

Detergent for Aluminum

Rapid cleaning of aluminum, anodized aluminum and magnesium parts in power washing equipment is made possible with the development of a detergent known as Kelite PWB No. 81, which is a powder readily soluble in water. It affords complete removal of virtually all types of soil, including Reynolds, Alcoa and Kaiser ink marking in approximately one minute. It is non-foaming, noncorrosive, has extreme stability and long life. Developed to the specifications of a leading aircraft manufacturer, the product is now available commercially. Made by Kelite Products, Inc., 1250 North Main St., Los Angeles 12. **T-9-1132**

Electronic Detector

The Electro-Probe developed by Erwood, Inc., 1770 Berteau St., Chicago 13, incorporates a pickup probe and a three-stage amplifier, is super-sensitive to vibrations at point of contact but unaffected by air-borne noises. Speaker and headphones provide audible comparison of vibration sounds within a range of 60 decibels; calibrated meter provides visual indication.



This relative indicating device enables maintenance men to detect and diagnose trouble developing in running motors or machines before failure occurs. Inspectors find that once a reading has been established for an acceptable part or assembly, others off the production line can be quickly passed or rejected on comparative readings. Addition of an accessory item permits use of the Electro-Probe as a surface gage. **T-9-1141**

Linear Ball Bearing

Thomson Industries, Inc., Manhasset, N.Y. announces the production of a new large size linear ball bearing for use on two-and-one-half inch diameter shafts. Heretofore these bearings, called ball bushings, have been available only in substantially small sizes which were not suitable for heavy load applications or where extreme rigidity requirements dictated the use of heavy supporting shafts.

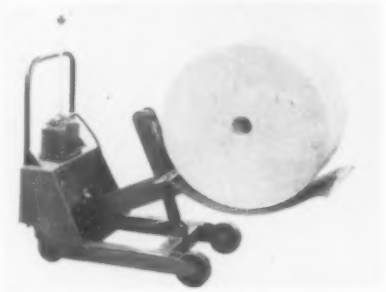
The availability of this large size brings the many advantages of this type of bearing to engineers and designers of machine tools, special machinery, and heavy equipment where linear motion is found. Their use on guide rods, for example, in place of plain sliding bearings which previously had to be used, will afford an extremely long life of exact precision alignment, since the near zero friction eliminates wear as well as the possibility of binding or chatter.

Their linear freedom is not dependent on the presence of an exposed oil film which, in the case of plain bearings, causes serious trouble when it becomes grit laden and gummy. Also, inaccuracies due to variations in oil film thickness and condition do not have to be considered. **T-9-1142**

Hydraulic Lifter

A hydraulic lifter for raising and lowering heavy rolls in restricted areas is now available from the Service Caster & Truck Corp., Albion, Mich. The lifter will load and unload rolls of paper, cloth, aluminum, leather, rubber belting, etc. weighing up to 1,000 pounds from presses, looms and other roll-fed machinery. It protects rolls of expensive materials from being damaged, speeds up roll changing and handling, and in many cases enables one man to do the job. It eliminates need for overhead cranes and slings, and increases safety.

The lifter is custom-built to suit in-



dividual requirements. It may be furnished with trunnions for handling rolls that have a shaft or spindle or with a scoop for handling cylindrical objects such as barrels that have no shaft. For horizontal movement, the lifter is mounted on four steel casters, two rigid and two swivel for easy steering. A floor lock can also be furnished. Wheel base dimensions are kept small so the lifter can be maneuvered through narrow aisles and between closely spaced machinery. Although most lifters are hand operated, an electric hydraulic power unit can be installed if desired. **T-9-1151**

Temperature Controller

For accurately controlling operating temperatures ranging from minus 100 deg F to plus 600 deg F, Thermo Electric Co., Inc., Fair Lawn, N. J., is introducing their thermo electronic temperature controllers using resistance bulb sensitive elements. These instruments are built with single or duplex control action and are available in six different temperature ranges. The standard resistance bulbs, designed for use with these controllers, cover practically all process applications. The instrument has a relay with load contacts for operating heating elements, motor starters, electric valves, and signal contacts for the two red and green lights on the instrument door. These signal lights are boldly visible over a wide angle at distances up to 100 feet.

When the temperature at the resistance bulb deviates as little as 0.1 deg F from the control point setting, the

instrument takes immediate corrective action. The control action is continuous. The electrical measuring system completely eliminates time lags in transmitting temperature changes from the sensitive element to the instrument. The calibration of the measuring circuit is accurate within ± 0.25 percent of the scale range.

Stabilized manganin wire resistors maintain the accuracy which is not dependent on mechanical parts. At the same time, calibration accuracy is unimpaired by variations in either the AC voltage or in resistance of the connecting cable from bulb to instrument.

The control relay is the only moving part in this instrument, which operates on a-c current. Standard vacuum tubes are used in the electronic circuit. Controllers are suitable for flush panel or wall mounting, require no leveling, and need not be mounted in a vertical position. **T-9-1152**

Chamfering Machine

A Burr-Master model BM-20[illegible], the first in a line of machines for chamfering zerol bevel gear teeth is announced by Modern Industrial Engineering Co., 14230 Birwood, Detroit 4. The machine deburrs and chamfers tooth edges at both heel and toe of an 8-in. diameter, 99-tooth, 12.53 pitch aircraft zerol bevel reduction gear in 30 seconds' cutting time.

Pressing the cycle start button on the machine causes the work to be brought into cutting position by a pneumatic cylinder. The teeth are then chamfered by rotating the work in timed relation to the cutting action of four dovetail-type high-speed-steel form tools. When the cutting cycle is completed, the work is lowered into unloading position automatically.

Four form tools are provided to chamfer the entire tooth contour at both heel and toe ends. These tools are actuated by a combination rocker arm motion that gives a generated cutting action which enables the form tools to chamfer and deburr the tooth edges well around the root of the gear tooth, leaving a burrless chamfered surface.

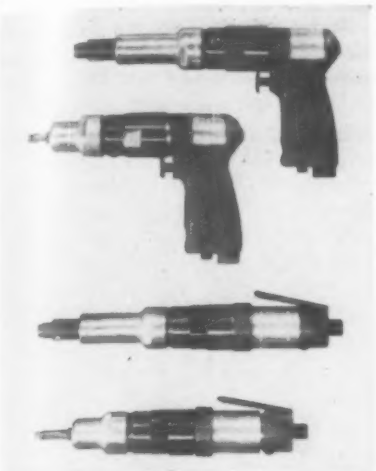
The zerol bevel gear is located in the fixture by a pilot. Three spring-loaded locators spaced at 120 deg (for accessibility) on the outside of the fixture are provided for radial location. The operator locates the part radially in the fixture by depressing any of the locators into a tooth space.

Clamping of the work in the fixture is accomplished by sliding a C-washer over a draw bar and turning a handwheel under the fixture. The work is unclamped by loosening the handwheel and sliding off the C-washer.

In actual operation, the head of the machine is enclosed with a guard having sliding doors. This guard is provided for operator safety as well as chip control. **T-9-1161**

Air-Driven Tools

A series of midget-size air-driven screwdrivers and nut-setters has been added to the line of portable air tools made by Master Pneumatic Tool Co., Inc., Elyria, Ohio.



Used for driving nuts, bolts and screws in all types of assembly and sub-assembly operations, this series of air tools is rated for driving screws up to size #12, and for nuts and bolts up to ¼-in. diameter bolt size. Three types of clutch mechanisms are adaptable to three different free speeds. They are 580, 1200 and 2400 rpm.

The tools can be fitted with either pistol or lever type throttle handles, and have spindle adapters for both screwdriver bits and nut socket adapters, providing a total of thirty-six different models. **T-9-1171**

Band Saw

A claw tooth saw band has now been made available to industry by The Do-All Co., Des Plaines, Ill. The saw band features a positive rake angle at the tooth tip, i.e., an angle more acute than 90 deg, giving the teeth a hooked, claw-like characteristic. This characteristic facilitates tooth penetration into the material being sawed. The hooked tooth actually pulls into the material, affording free cutting; also less feed pressure is required than is commonly employed on certain sawing operations.

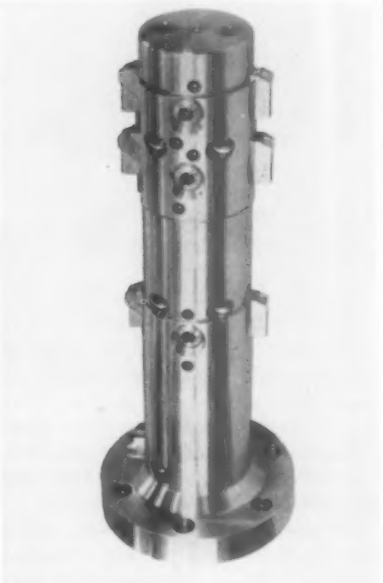
The claw tooth band is a premium, hard edge, flexible-back saw band which is not intended for resharpening because of the extreme hardness of its cutting teeth.

Claw tooth saw bands are available in 7 standard widths ranging from ¼ to 1½ in. and in pitches, depending upon width, of 2, 3, 4 and 6. They are supplied in 100- and 500-foot lengths in strip-out containers, or in convenient cut and welded lengths ready for immediate use on a band machine. **T-9-1172**

Boring Tool

A three-in-one car wheel boring tool made by the Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., is now in use in several railroad repair shops to bore cored hub wheels.

Boring problems caused by the core openings which tend to deflect bar travel are eliminated with the tool. In addition, unusual machine wear because of such deflection in this type of boring has been entirely eliminated.



The successful operation of the three-in-one boring tool is embodied in a set of extra cutters located between the first roughing cutters and the final finishing cutters. Arrangement of these intermediate cutters provides for continuous cutter contact in the bore during the boring cycle regardless of the cored openings in the wheel hub. Cutters actually support the boring tool in the bore, lending rigidity to both the bar and machine ram. This in turn prevents deflection which might cause serious ram distortion and needless breakage of cutters.

The car wheel boring tool is equipped with Davis micrometer expansion blocks in which blades or cutters of solid tungsten carbide are used. Longer life can be expected from such blades for there are no brazing strains or other imperfections often found in tipped cutting tools. The solid blade is rigidly supported in the tool block which prevents chattering and premature cutter breakdown when boring. **T-9-1181**

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Wire Terminator

The Amp-O-Lectric wire terminator is an automatic machine developed and manufactured by Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa., for applying its solderless terminals to wire. It is capable of applying terminals at rates of up to 4000 per hour, depending upon the type of terminal and the dexterity of the operator.

Designed for mass production of precision wire terminations, the machine is especially suited for the aircraft, automotive, electronics, railroad and appliance industries. Hundreds of types and sizes of solderless terminals and connectors are available.

A-MP solderless terminals in strips are fed from a reel into the machine which operates either automatically, when the wire is placed in the target area, or by micro-switch foot pedal. Preset precision crimping dies, accurately ground for exact closure, cut the terminal from the strip and crimp it to the wire.

Because of its compactness and functional design, this electrically operated machine may be bolted to a workbench and plugged into an ordinary 110-v a-c outlet. It weighs approximately 225 lb and is 35 in. high, 24 in. wide and 30 in. deep.

No capital investment is required on the part of the user of this machine. It is provided on a loan basis on receipt of an order for specified quantities of A-MP solderless terminals. **T-9-1191**

Bronze Needle Valve

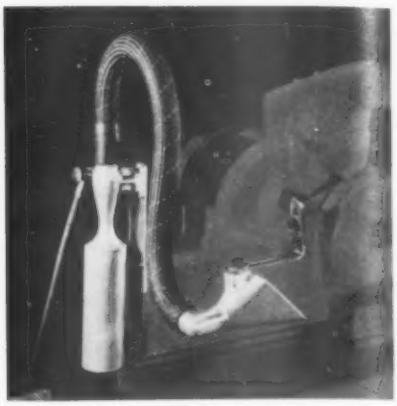
Introduction of a gland-type bronze needle valve, has been announced by The Lunkenheimer Co., Cincinnati 14, Ohio.

The needle valve is small and compact, making it ideal for use in pinpoint control on small lines where fine regulation of flow is essential. It is manufactured in a range of sizes from $\frac{1}{8}$-in. to 1 in. and in both globe and angle patterns. The handwheel is Lunkenheimer's non-slip design, which lends itself to finger-tip control.

This control valve is also being produced in an indicator model. The indicator needle valve globe type is available in $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$-in. sizes; the angle type in $\frac{1}{4}$ and $\frac{3}{8}$-in. sizes. The handwheel on the indicator needle valve is of cast bronze and has numbered graduations indicated on its face, permitting resetting to a pre-determined degree of opening. A spring clip engaging serrations on the outside of the wheel, holds the valve securely at its proper setting. **T-9-1192**

Individual Dust Units

These compact units, with no moving parts, can be operated from your present air supply. Installed in a few minutes, centrally located dust collecting systems are available in two sizes: 200 series with 24-cubic-inch capacity for grinding wheels 2 in. in diameter or under and the 700 series with 56-cubic-inch capacity for grinding wheels 7 in. in diameter or under.



Vulcanaire dust collecting units are quickly cleaned, requiring no refills. Positive location of dust cup is assured by mounting on the grinding wheel guard or close to the grinding wheel on other applications. This permits constant contact with dust as the wheel is moved up or down. The collector element is mounted on the side of the machine. A needle valve operates the unit and can be shut off when machine is not in use. Made by The Vulcan Tool Co., 730 Loraine Ave., Dayton 10, Ohio. **T-9-1201**

Spring Coiler

This hand-operated spring coiling machine for making compression, extension and torsion springs has been completely redesigned to include a structural steel baseplate, an improved method for cam adjustment, and several other features which make it especially useful for making experimental and small production lots of springs up to about 1000 pieces.

Compression springs are coiled with both ends squared automatically. Extension and torsion springs can be wound either left or right hand with long extended arms on both ends. The set-up time is usually less than five minutes, and about 300 precision springs exactly alike can be wound per hour.

Capacity: Wire diameters from 0.004 to 0.063 in. with outside diameters up to 1 in. and spring lengths up to 4 in. Arbors, wire cutters and extra coiling points are included. Made by The Carlson Co., 277 Broadway, New York 7. **T-9-1202**

Chaser Sharpener

Designed to resharpen chasers, this machine allows heavy expensive machine tools to be freed for their intended uses.

It is equipped with a chaser grinding fixture and adapters for all sharpening operations, for both tangent and radial die chasers. Adapters for J & L chasers are available from stock, while adapters for other chasers can easily be applied to the J & L chaser grinding fixture.

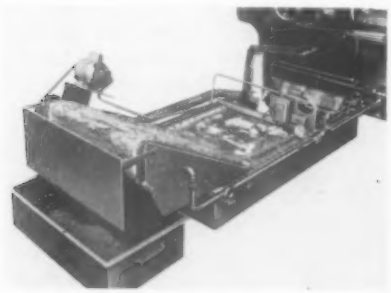
This machine will duplicate desired grinds repeatedly. It is a precision machine tool equipped with all necessary stops and controls. Simple direct methods speed up the operation and cut costs. Even an inexperienced operator can, in a few minutes, learn to resharpen chasers on this machine.

A bench space 14 x 28 inches is ample for the complete chaser resharpening operation. Made by the Jones & Lamson Machine Co., Springfield, Vt.

T-9-1211

Endless Belt Filter

Through the use of an endless belt the Delpark industrial endless belt filter permits utilization of the same filtering media over and over. This filter is designed to serve individual machine tools or larger central coolant systems.



The Delpark filter is a continuous, self-cleaning gravity filter. It filters solids from liquids that will flow by gravity through filter material and discharges the solids, in a relatively dry state into an outside container.

The filter material in the form of endless belting, rests on and conforms to, a flat endless conveyor of open construction. Sloping sides form a shallow pool of the conveyor and an inclined discharge ramp provides for the removal of filtered solids, which are discharged from the endless belt at the end of the ramp into the disposal container.

Capacities range from two gallons per minute to units capable of filtering 1000 gallons per minute.

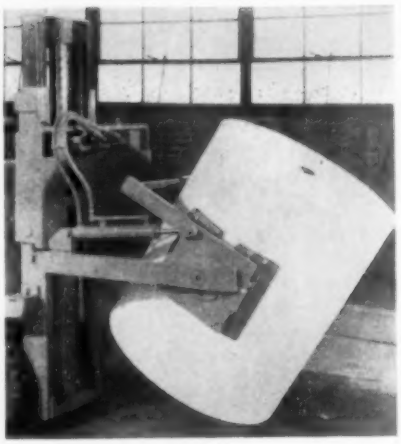
Delpark endless belt filters are manufactured by the Delpark Corp., Lebanon, Ind. **T-9-1212**

Fork Truck Roll Clamp

A detachable roll clamp attachment for fork trucks, designed to pick up and stack cylindrical objects either horizontally or vertically, has been developed by the Baker-Raulang Co., 1230 West 80th St., Cleveland 2.

The clamp allows truck operators to pick up and haul paper rolls, drums, large pipe or any other cylindrical material from a foot-and-a-half to three feet in diameter. It rotates 90 degrees in a vertical plane so that loads may be stacked either vertically or horizontally. Clamping pressure is controlled by an adjustable relief valve in the hydraulic system, permitting operators to control clamping pressure for each type of material handled.

With the clamp removed, the truck operator is able to use the side-shifter



to get in close to columns and warehouse walls with his pallet loads. Installed on Baker's four-purpose carriage, a special fork truck carriage which combines the features of fork-spacing, side-shifting, clamping and standard fork use, the clamp detaches in two minutes.

Two men can detach the clamp by removing retaining pins at the base of the truck carriage, detaching two push-pull Hansen couplings on the clamp's hydraulic line and lifting the clamp off the carriage. Next, a set of forks is installed and locked by the retaining pins—and the truck is ready for pallet loads. **T-9-1221**

Indexable Carbide Tool

Greater rigidity over other indexable lathe tools is the primary advantage claimed for this tool. Practically the entire shank size is beneath the solid carbide cutting blade, and both the latter and the seat on which it rests are super-finished to gage block flatness. The carbide cannot flex or bend under strain.

Another advantage claimed is that no grinding or no diamond wheel is necessary unless the user wishes to regrind his own blades. The solid carbide cutting blade which is $\frac{7}{8}$ in. square by $\frac{3}{16}$ in. thick can be indexed eight times and then sent to the manufacturer, where it is reground on a special grinder. The chipbreaker which is positioned on top of the cutting blade has extremely long life since, being a separate blade, a cast iron abrasive grade of carbide is used.

The same tool holder can be used for either turning or facing by turning the chip breaker from the side to the

front. Adjustments provided include bringing reground blades out frontally or laterally, varying the chip breaker from parallel to angular, and changing either the end cutting edge angle or the side cutting edge angle.

Clearance is provided for the cutting edges by positioning the blade in the holder with double negative rake angles, and for turning and facing into a 90-deg shoulder a parallelogram blade is furnished to give additional clearances necessary.

Many modifications of the basic design are possible for use on tracer lathes, for shell turning and for employing round inserts on various applications. Made by the Detroit Milling Cutter Co., 28625 Grand River, Farmington, Mich. **T-9-1222**

Grinder

Internal and face grinding operations are performed in a single setting of the workpiece in the Reinecker model JSOP machine, which is distributed in the United States by Kurt Orban Co., Inc., 205 East 42nd St., New York 17. Combining both operations in one set-up reduces rechucking and centering time, assures a ground face which is true to the bore and increases output. Operation is by single lever control for rapid travel, grinding movement, work spindle rotation and coolant flow. Chucking of the workpiece is done by magnetic, collet or 3-jaw chucks.

Semi-automatic wheel redressing guarantees uniform accuracy for large quantities of workpieces. Precision angular adjustment enables the grinding of inside tapers up to 30 deg. The Reinecker grinder provides hydraulic, infinitely variable table movement, grinding wheel infeed and hydraulic movement of the face grinding bracket, which is adaptable for cup and face wheels.

Working range: Bores from 0.16 to 3 in. in diameter; maximum grinding depth, 5 in.; maximum face grinding diameter, 9 in. The machine is also available without face grinding equipment as Model JSO.

Replacement parts and engineering assistance will be available at the Kurt Orban Service Center, 4220 Prospect Ave., Cleveland. **T-9-1231**

Magnetic Base Test Set

A strong, 100-lb pull Alnico permanent magnet in the base of the Geneva magnetic base test set permits the test set to be positioned quickly on flat or curved surfaces without cumbersome, time-consuming clamping. A flick of the finger releases the magnet, and the set can be removed or positioned without jarring the indicator.

Fast, accurate readings in contour, dimension, or roughness and complete adaptability to any measuring situation are features of this unit. Three models of the test set are available, all finished in machine gray. Each includes the Geneva magnetic base, a holding rod $\frac{3}{8}$ in. in diameter by 8 in. long, and the Geneva dial indicator with center lug back $\frac{5}{16}$ in. in diameter by 6 in. long holding rod and knurled screw. For further information, write Chicago Dial Indicator Co., 180 N. Wacker Drive, Chicago, Ill. **T-9-1232**

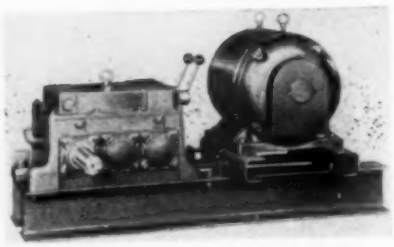
USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Multi-Speed Transmission

The Turner Machinery Co. announces three new models of multi-speed power units for heavier horsepower applications.

Models 2004, 3004 and 5004 transmissions are available in ratings up to 60 hp, thus making them adaptable to a wide range of heavier applications. The units are suitable for use wherever it is necessary to vary the turning speed of electrically driven equipment or machinery. Many installations are in connection with internal-combustion engines where it is advantageous to turn the engine at a constant speed and vary the output speed with the multi-speed transmission.

While all transmissions are available in four speeds, with a selection of different speed ratios, some models can be supplied with six and nine speeds.



A practical feature of these transmissions is the availability of two different type mounting brackets. The type RMB is a vertically mounted arrangement with the motor mounted on a hinged plate directly over the transmission. Type H-beam mounting is the motor mounted in front of or behind the transmission. The motor slide rails on the H-beam have both lateral and longitudinal adjustment to accommodate different motor frames and belt take up. Made by Turner Machinery Co., 3420 Terrace St., Kansas City 8, Missouri.

T-9-1241

Nylon Powder

It has recently been discovered that nylon can be processed by sintering techniques. The Polymer Corp., Reading, Pa., announces the development of a finely divided nylon powder, having a particle size below 10 microns, produced by a special chemical process which makes it suitable for cold pressing and sintering techniques, similar to those practiced in powder metallurgy. Known as Nylasint 66, the powder will be sold by a newly formed subsidiary company, National Polymer Products, Inc., Reading, Pa.

The powder lends itself to the production of sintered nylon bearings, gears, cams, rollers, valve seats, and other industrial products, which appear to have certain advantages over similar injection molded items. Since the nylon powder is processed below the melting point, there is less tendency to internal strain in sintered nylon with consequent greater dimensional stability in service. In addition, the use of a powder without melting enables uniform blending of nylon with a wide range of fillers for reducing thermal and hygroscopic expansion, or to obtain special electrical properties.

Nylasint 66 is basically similar to the FM10001 grade of nylon familiar to the molding industry. The sintered product has comparable chemical, hardness, and wear resistant properties, but somewhat lower toughness than the molded product.

For further information, or for a technical bulletin which details the methods of producing sintered nylon parts from Nylasint 66, write to The National Polymer Products, Inc., Box 422, Reading, Pa. **T-9-1242**

Gear Shaper

An improved series 1800 line of Shear-Speed gear shapers is announced by Michigan Tool Co., 7171 E. McNichols Road, Detroit 12. Twelve design features provide improved performance, reduce tool change time, and facilitate machine maintenance. Model 18501 with a 5-in. cutter head stroke replaces the former model 18103 which had a 3-in. maximum stroke.

The series 1800 line now includes four models: 1833, 1853, 1873, and 18105. These models have capacities ranging from 1 to 10-in. diameter gears with maximum face widths ranging from 2¾ in. to 4½ in. The line is designed for cutting of spur gears, involute, angular, straight-sided and inverted splines, sliding clutches, toothed parts, ratchets and special forms.

T-9-1243

Marking Sets

A type holder and interchangeable steel number and number and letter set has been introduced by The Parker Stamp Works, Inc. Marking flexibility is assured since hand or press stamps for any job, or any material can be set in seconds. Serial numbers, firm names, dates are always available. These Parker sets include a variety of standard size letters selected to provide

maximum utility. An interchangeable threaded shank is included with each set. This allows changes from hand stamps to press stamps. Sets are available in a number of different sizes with varying combinations of numbers or numbers and letters. Each set comes complete with a hardwood case to facilitate storage.

Further information may be obtained by writing The Parker Stamp Works, Inc., Franklin Ave., Hartford, Conn.

T-9-1251

Safety Vises

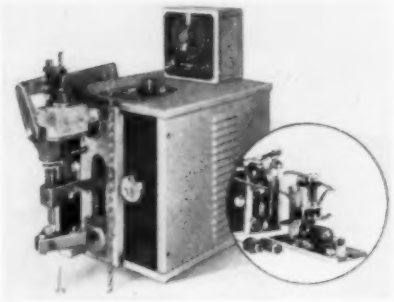
Safety vises, unique in design and flexibility, extend the usefulness of drill presses and band saws. Manufactured by the Float-Lock Corp. subsidiary of American Machine & Foundry Co., 511 Fifth Ave., N. Y. 17. AMF Float-lock universal safety vises are full-floating tools which can be used in a wide variety of set-ups in tool rooms and on production and assembly lines.

Easy to mount, the drill press model can be quickly locked in practically any position on the table; clamps, straps, bolts and other gadgets are eliminated. Regular, end or angle drilling can be done easily, and the vise becomes a dependable jig when duplicate pieces are required or repeat assembly operations must be made. The vise turns over on three sides for maximum flexibility, and swings completely out of the way when not in use. Maximum capacity is eight in.

The band saw model, with a 10-in. maximum capacity, enables the operator to do all types of sawing without touching the material. The vise can be used in cutting vertical pieces, compound and simple angles. **T-9-1252**

Spot Welding and Soldering Machine

A resistance spot welding and soldering machine, equipped with timer, silver solders, soft solders and spot-welds precious and dissimilar metals. It spot-welds steel parts up to $\frac{3}{16}$ in. in thickness; spot-welds copper to bronze, copper to copper up to 0.040 in. and brass to brass up to 0.080 in. It will solder brass up to $\frac{1}{4}$ in. in thickness.



The machine features a quick-adjusting device for pressure control and length of electrode travel for positive soldering and welding. Special engineering assistance is available if required.

The set-up time for the various production operations is simple and rapid. Electrodes are especially designed for each job. Their operation is spring-action controlled so that, when electrode arms are closed, work is held firmly in position during soldering and cooling.

An automatic cut-off timer regulates soldering time. Heat control with eleven adjustments determines correct heat for the job. When dials are set, uniform soldering time, heat, and holding pressure on the electrodes are maintained, regardless of how long work is held between jaws. Thus, all chance of work burning and consequent shrinkage is eliminated.

For information write to Joyal Products, Inc., 56 Belmont Ave., Newark 3, N. J. **T-9-1261**

Optical Level

An optical level for measuring flatness, straightness and parallelism reads deviations from the horizontal of 0.00012 in. per foot of length or 0.00001 in. per inch of length. This inherent accuracy makes it possible to check the flatness of surface plates and machine tool beds, the straightness of cylindrical rolls and the parallelism of V-ways or flats to values well within the closest working tolerances.

The most critical leveling and measuring operation can be performed and there is no limit to the length of work that can be checked. Simply by moving the level along a surface 7 in. at a time (the length of the instrument) or in shorter increments and by taking a series of readings the entire length of the surface can be checked and plotted on graph paper.

Applications include dozens of everyday leveling and checking operations such as inspecting flatness conditions of machine beds, surface plates, ground shafts, paper and dryer rolls, jigs, fixtures, airframes, lofting, lapping plates and checking spindle arbor runout.

The optical system consists of three bubble phials and two prisms so arranged that twice the usual accuracy of level reading is obtained and a very exact reference is observed. The amount and value of deviation from the true horizontal in the work piece being examined are measured by means of a large-diameter graduated micrometer thimble and barrel with easily read figures and markings. Readings may be made very rapidly, each in a few seconds.

Further information is contained in catalog No. 30 available from F. T. Griswold Mfg. Co., W. Lancaster Ave., Wayne, Pa. **T-9-1262**

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Rotating Face Plate

A 48-in. rotating table is announced by Machine Products Corp., Detroit. It is suitable for radial and boring mill applications.

A motor located immediately under the table and hooked up to it by direct drive and controlled by a pushbutton, rotates the 48-in. diameter table at five rpm (or to specifications) and simplifies set-up of work. A hand wheel is used to complete the setting to precision accuracy within two minutes by vernier graduations found on a scale just under the table. This face plate can be rotated to any degree, and can be adjusted to any angle from the vertical to the horizontal position, and to 30 deg below the horizontal the opposite way. It can be locked in any position.

The surface of the plate is divided by 8 tee slots $1\frac{1}{16}$ in. wide running to the outer rim to provide clamping facilities.

This machine is provided with a centering plug and 10-in. sine bar. Marking rings are scribed in the face plate to facilitate set-up. Overall height to top of face plate in horizontal position is 35 inches. Distance from base to center line of face plate in vertical position is 26 inches. **T-9-1271**

Coolant System

A simplified, low-cost coolant pump and motor assembly, which, when immersed in a pail or other container of coolant, becomes a complete coolant system, has recently been introduced by Factory Tools, Inc., 4706 W. Arthington, Chicago 44.

The unit's built-in, high volume vane type pump, driven by a fully sealed 1/30 hp motor, delivers a steady stream of coolant or oil through the 4-ft. long semi-rigid flexible metal hose which is equipped with a variable volume nozzle. The nozzle permits selection of coolant flow from a trickle to full volume. The semi-rigid metal hose provides fast, easy positioning of the nozzle for delivery of the coolant stream at any desired point. The service life of the metal hose is indefinite, since it resists abrasion, scuffing and harmful effects of oils, acids, and other solutions injurious to ordinary rubber hose.

Supporting legs of the unit are threaded to permit height adjustment of the pump and motor for the container and the coolant level. The legs are angled out to provide a stable support for the assembly.

The unit is supplied with a heavy 6-ft. rubber covered electric cord complete with built-in on-off switch. **T-9-1272**

Technical Shorts . .

As a result of extensive study of the austenitic stainless steel alloys, metallurgical researchers at the laboratories of the Superior Tube Co. have reaffirmed and re-emphasized five major danger areas which must be watched during heat treating of austenitics. Due to their excellent resistance to staining, discoloration and corrosion these alloys are among the most useful family groups in the metal fabricating field, but considerable care must be exercised in their annealing and hardening and their handling during fabricating processes to insure maximum length of life and efficiency.

Danger points included:

1) Carbide precipitation in temperature range 900 to 1600 deg F. Therefore, it is suggested that slow heating through this range be avoided and that 1900 deg F be regarded as the minimum annealing temperature. Also rapid water cooling would lower the temperature quickly through the critical range. Where water quenching causes appreciable distortion, it was pointed out that air chamber cooling at a rate sufficient to bring the material below 800 deg F in a period of about two minutes would avoid precipitation.

2) Thin oxide of chromium which forms with alloys above 12 percent chromium and which is more difficult to remove than a heavier scale. By treating in atmospheres of completely dry hydrogen or cracked ammonia and under conditions effectively excluding air infiltration to the furnace muffle, the alloys can be bright annealed.

3) Absorption of carbon at elevated temperatures requires particularly careful cleaning by caustic or solvent vapor degreasing before annealing. Danger lies in the impaired corrosion resistance resulting from surface carburization.

4) Zinc embrittlement to which austenitic alloys are subject emphasizes the fact that any part formed on zinc alloy dies or brass guides or tools must be carefully cleaned before annealing. Pickling in nitric, hydrofluoric or other pickling solutions will satisfactorily prevent this problem.

5) Stress corrosion cracking is the final danger to be watched. When heavily cold-worked, these alloys seem inclined to crack subsequent to the working operations, particularly when severe local stretching is necessary. A tempering treatment at 600-800 deg F may often prevent it, though the warning mention concerning temperatures above 800 deg should be considered.

RADICAL REDUCTION in the cost of descaling rings for 20 mm shells has been reported by the Magnus Chemical Co. of Garwood, N. J., as a result of tests carried out in its plant scale laboratory.

The tests revolved around an inhibited acid cleaner, Magnus D-Scale-RS, developed by the company for use in a tumbling barrel without stones or other abrasives. The company reported the cleaner safe for use on copper alloys without danger of tarnishing or corroding. In furtherance of results obtained in the Magnus laboratory, rings were run with a hot water solution of the chemical without stones, which was said to give satisfactory descaling and a bright color in about 15 minutes.

★ ★ ★

A NEW METHOD of cold galvanizing for surface protection of steel and iron has been announced by the Galvanite Corp. of New York City. The announcement follows two years of extensive testing by researchers of the company.

During testing the cold galvanizing compound revealed its basic difference from other similar processes in that the "Galvanite" actually combined with the base metal, setting up electrical continuity and also offered true cathodic protection. It left a coating of 96 parts, by weight, of chemically pure zinc. In instances where it was applied directly onto adhering rust, researchers reported that the Galvanite induced the rusted area to create its own non-flaking coating, thus stopping any further rust and preventing "rust creep." One such test involved the coating of bright and rusty steel treated which was then submerged in salt water for two years. After this long immersion period, scratch tests showed both samples to be free of any loose rust.

Other advantages claimed by the company for its new process include simplicity of application, speed and economy.

★ ★ ★

ALTHOUGH SPINNING and drawing both have been used for many years in working zinc, so little information has been published on the subject about the metal's desirable qualities for these purposes and thus it remains to many in the metalworking field a comparatively unknown quantity.

In an effort to correct this situation, the American Zinc Institute has prepared two folders containing basic data on spinning and drawing of zinc especially emphasizing lowered costs. The folders are offered to anyone interested from the Institute's headquarters, 60 East 42nd St., New York 17.

North East West South IN INDUSTRY

Wallace E. Anderson has been promoted to the position of division superintendent of the newly created Precision Tool and Gage Div. at the **Brown and Sharpe Mfg. Co.** He was formerly with the sales department.

At the same time **Samuel H. Waughel, Jr.** was named division foreman. He has recently returned from a special assignment with N. P. A.

Meeting in Hot Springs, Va. in their twelfth annual convention, members of the **Alloy Casting Institute,** a technical association of high alloy foundries, elected officers for the coming year. **Harvey T. Harrison,** executive vice-president of the Duraloy Co., was re-elected as president, and **G. A. Baker,** vice-president of the Dueiron Co., was elected as the new vice-president.

The Allis-Chalmers Mfg. Co. has announced the recent retirement of both **Dr. Soren H. Mortensen,** chief electrical engineer of the power department, and his assistant **Fraser Jeffrey.**

Both men are pioneers in the electrical industry and are widely known through their numerous technical writings and appearances before engineering groups.

Two appointments have been announced by the **Sundstrand Machine Tool Co. B. A. Gustafson,** formerly manager of the Machine Tool Div., has been appointed vice-president of the company and **Edgar O. Landstrom,** formerly manager of the Pneumatic Products Div., has been appointed secretary of the company.

B. A. Gustafson

Karl V. Rohlen

Two important announcements have been made by the Board of Directors of the **Crane Packing Co. Karl V. Rohlen,** former vice-president, has been promoted to the presidency. Mr. Rohlen succeeds **Frank E. Payne** who has been elected chairman of the board to fill the vacancy left by retiring Chairman **A. W. Payne.**

The appointment of **Helmut Thielsch,** formerly of the Welding Research Council, to the position of director of applied welding engineering has been announced by the **Eutectic Welding Alloys Corp.**

The **Luria Engineering Co.** recently announced the appointment of **John H. Porteus** as chief engineer. Mr. Porteus was until recently assistant chief design engineer in the machinery division of the Dravo Corp.

William Rogers Herod has been elected a vice-president of the **General Electric Co.** Mr. Herod has been president of the International General Electric Co., which is now being merged with General Electric, since 1945.

Sterling Engineering Corp. has named **Raymond T. Fenn** as chief engineer. Mr. Fenn, formerly electrical engineer at Bryant Chucking Grinder Co., will direct a new electrical and mechanical engineering consulting service for machine builders and users.

E. Swain **Russey** is the new president of the **Warner Gear Div.** of **Borg Warner Corp.**, following his election at the annual meeting of the Supervisory Board. He will succeed **A. F. Ennert**, who retired after 25 years of service with the division.

The company also announced the appointment of four new vice-presidents. They are: **T. J. Ault**, purchasing agent; **William H. Cortwright**, works manager; **John C. Oesterle**, sales office manager; and **Andrew W. Rose**, assistant general manager.

The engineering staff of **Carboloy Dept.** of **General Electric Co.** has made four appointments to newly created executive positions. Named to new top level posts are **E. W. Engle**, Product and Process Engineering manager; **E. E. George**, Design and Application Engineering manager; **R. A. Canning**, Production Engineering manager; and **R. L. Brownlee**, Administrative Engineer.

Mr. Engle was formerly manager of Process Engineering; Mr. Canning, manager of Service Engineering and Mr. Brownlee, manager of Production at the Carboloy plant in Detroit. Mr. George was formerly manager of Permanent Magnet Engineering in Schenectady.

Arch Morton, head of **Morton Machine Works**, after a year's absence again resumes active management and will now supervise all of the company's activities.

Paul W. Taylor, former head of the Special Assignment Div. of the Cadillac Tank Plant in Cleveland, Ohio, has been appointed as Morton's manager.

Stanley C. Johnson has been appointed chief abrasive inspector for **Norton Co.**, replacing **Harry O. Anderson** who retired after 51 years with the company. Mr. Johnson has been with the company since 1947 and has served as Mr. Anderson's assistant.

OBITUARIES

Thomas Cruthers, vice-president of **Worthington Corp.** since 1936, died in West Orange, N. J., recently. Mr. Cruthers started with the company in 1907 as head of the Gas Field Erection Dept. Later he served as sales engineer, sales manager, and assistant vice-president in the general sales department.

Wallace Tenney Montague, vice-president of **Norton Co.**, died recently at the age of 63. Mr. Montague's career in the abrasive industry included directorship of the Grinding Wheel Institute and former board chairman of both the Grinding Wheel Manufacturers Assn. and the Abrasive Grain Assn.

Coming Meetings

Sept. 4-5, eighth national conference on Industrial Hydraulics sponsored by **Illinois Institute of Technology** held in conjunction with Centennial of Engineering. Sherman Hotel, Chicago.

Sept. 9, Centennial Conference on Industrial Research, sponsored by the **Armour Research Foundation** of **Illinois Institute of Technology**. Illinois Tech campus.

Sept. 8-12, fourth annual Industrial Engineering Conference sponsored by Industrial Engineering Section, Mechanical Engineering Department, **Michigan State College**, East Lansing.

Sept. 10-12, 14th annual shop practice forum of the **Porcelain Enamel Institute** at University of Illinois, Urbana. Open to both members and nonmembers of PEI.

Sept. 30-Oct. 3, 1952 Iron and Steel Exposition and the annual convention of its sponsoring organization, **Association of Iron and Steel Engineers**, Cleveland Public Auditorium, Cleveland, Ohio.

TRADE LITERATURE

Free Booklets and Catalogs Currently Offered By Manufacturers

Gear Hobbing

Twelve-page illustrated brochure presents Model 1458-A Michigan ultra speed gear hobbing machine, giving complete design and operating descriptions, tooling layouts for hydraulic clamping and general machine specifications; picture sequence shows machine in action; emphasizes advantages in economy and accuracy. **Michigan Tool Co.**, 7171 E. McNichols Rd., Detroit 12. **L-9-1**

Spray Nozzles

Widely illustrated catalog 5200 specially aimed toward helping those responsible for specification of spray nozzles for metal cleaning, bonderizing, spray quenching, gas washing or similar industrial applications; cutaway drawings show construction and operation, and engineering drawings show proper installation details; indexed for quick reference. **Binks Mfg. Co.**, 3122 Carroll Ave., Chicago 12. **L-9-2**

Taps

Tap manual includes latest information on taps for British-American Unified Threads; also contains data on tap-drill sizes, tap selection for kinds of work, material, feeds, speeds, how to sharpen taps, types of coolants and screw thread terms and definitions. **Besly-Welles Corp.**, Beloit, Wis. **L-9-3**

Roller Chain

Illustrated 148-page engineering data book No. 2457 deals with rollerchain and its application; covers selection, installation, lubrication and maintenance for drives and conveyors as well as sprocket wheels. Formulas, charts, diagrams and typical problems simplify proper selection. **Link-Belt Co.**, 307 N. Michigan Ave., Chicago 1. **L-9-4**

Rivets

Pocket size rivet selector disc enables automatic selection of proper clinch allowance, assembly hole diameter and rivet head diameter for a proposed size and type of rivet; selector also gives rivet catalog number for any steel or brass rivet. **Chicago Rivet & Machine Co.**, Bellwood, Ill. **L-9-5**

Form Duplication

Brochure reports on decentralized form duplicating and how it operated in one plant emphasizing speed, accuracy, quality, versatility and economy. Widely illustrated, the discussion enters all details of the system, how it was adapted, and the extensive saving made. **The Haloid Co.**, Rochester 3, N. Y. **L-9-6**

Drilling

Comprehensive sixty-two page revised handbook, "Drills and Drilling Practice," includes complete information with diagrams and tabular engineering data on drills and drilling all kinds of materials gained from 50 years experience in the field. Handling charge of **$1.** Engineering Dept., **National Automatic Tool Co.**, Richmond, Ind. **L-9-7**

Furnaces, Case Hardening

Controlled atmosphere equipment, including muffle furnaces and generators plus salt bath pot furnaces and direct-fired oven furnaces are shown and described with typical applications to gas carburizing, liquid carburizing and cyaniding and pack carburizing in folder on standard batch furnaces for cash hardening steel. **Surface Combustion Corp.**, Toledo 1, Ohio. **L-9-8**

Machine Tools

Quarterly publication contains case histories of new and rebuilt machine tools; first edition, now available, shows bar, horizontal boring and facing machines adapted for special deep-boring operations; also shows step-by-step descriptions of operations involved in rebuilding. Mailing lists now being formed. **Simmons Machine Tool Corp.**, 1700 N. Broadway, Albany 1, N. Y. **L-9-9**

Welding

Sixty-four page brochure, "Tool & Die Salvage Welding," fourth in series of "How-to-weld-it-better" manuals, illustrates latest welding developments and techniques in this field; photos, drawings, charts and diagrams present detailed picture of improved tool and die welding procedures. **Eutectic Welding Alloys Corp.**, Dept. P, 172 St. at Northern Blvd., Flushing 58, New York. **L-9-10**

Switches

High precision in a small package is the advantage emphasized in illustrated brochure carrying a reprint of "Aviation's Mighty Midgets" which tells the story of the tiny snap action switches and their part in building aircraft; widely illustrated. **Micro Switch Div. of Minneapolis-Honeywell Regulator Co.**, Freeport, Ill. **L-9-11**

Gages, Thread

Bulletin SG-52 covers thread plug, ring and setting gages for machine screw and fractional thread sizes; discusses types and uses of thread setting plug gages and lists 'W', 'X' and 'Y' tolerances for thread gages. Includes price lists and how-to-order information. **Detroit Tap and Tool Co.**, 415 Boulevard Bldg., Detroit 2. **L-9-12**

Grinders, Surface

Pictures, specifications and detailed discussions of special features (time-saving operating controls, built-in motor construction, angle and radius truing devices, special chuck demagnetizing unit, etc.) and pictorial demonstrations of range of work handled are included in brochure covering high-powered precision surface grinders. **Mattison Machine Works**, Rockford, Ill. **L-9-13**

Airfoil Grinder

Illustrated folder introduces turbine blade airfoil grinder emphasizing speed, accuracy, economy and other performance features and pointing out construction and design quality; complete specifications included. **Pratt & Whitney**, Div. Niles-Bement-Pond Co., West Hartford 1, Conn. **L-9-14**

Measurement, Surface

Illustrated wall chart lists working range of Profilometer equipment for measuring surface roughness in microinches; gives tabular listing of seven standard tracers, types and dimensions of internal and external surfaces that can be measured with each, and type of piloting used. Also includes recommendations on use of manual tracing, type V Mototrace and type A linear Pilotor and shows typical applications. **Micrometrical Manufacturing Co.** (formerly Physicists Research Co.), 345 S. Main St., Ann Arbor, Mich. **L-9-15**

Gaging

Instruction book on pneumatic comparator gage outlines principle of operation, installation and maintenance; photos, drawings and tables clarify the descriptions. **Moore Products Co.**, H. & Lycoming Sts., Philadelphia 24. **L-9-16**

Presses

Recently designed straight-side, double-crank S-2 presses, which incorporate dimensions and specifications established by JIC, are described in illustrated bulletin pointing out special features and advantages. **E. W. Bliss Co.**, Canton, Ohio. **L-9-17**

Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

THE WELDING OF NON-FERROUS METALS, *by E. G. West. Published by John Wiley and Sons, Inc., 440 Fourth Ave., N.Y. 553 pp; price $8.50.*

Welding of non-ferrous metals is a rather recent development, and with the wide-spread use of the newer materials such as magnesium and aluminum, is assuming greater importance daily in the field of metalworking. The problems to be faced and the techniques to be used differ from those when iron or steel are the materials to be welded. The individual characteristics of the various non-ferrous metal alloys must be known; the technical problems raised by each one must be dealt with.

This book is founded on the metallurgy involved in the operation of welding non-ferrous materials, which is the basic approach. However, the text itself is mainly concerned with the operational problems of the welding engineer, the welding operator, welding instructor and trainee. It will also be valuable to the designer, works engineer and metallurgist. The inclusion of both the how and the why of welding these materials makes it particularly useful.

BASIC METALLURGY, *by Carl A. Keyser. Published by Prentice-Hall, Inc., 70 Fifth Ave., N.Y. 11. 384 pp; price, $8.*

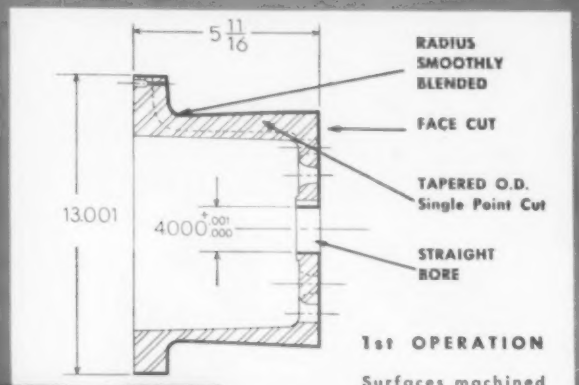
Intended primarily for students in all branches of engineering, this book also contains general metallurgical information of interest to engineers specializing in materials and methods.

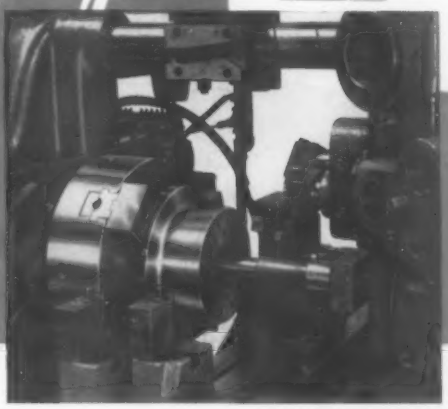
The first six chapters are devoted to a theoretical approach to the subject and include the concepts and principles of behavior common to most metals. The next two chapters contain information concerning the properties and heat-treatment of steel. Three chapters present a discussion of the properties, applications and fabrication of some non-ferrous metals.

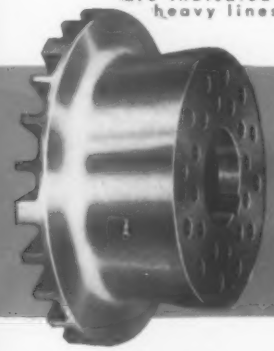
The last six chapters of the book discuss the advantages, limitations, and control of the various means of fabricating metals. Casting, electroforming and powder metallurgy techniques are discussed as primary methods of fabrication. Included is a treatment of some of the secondary methods of fabrication.

DOING *Hard Jobs* THE *Easy Way*

WITH SPEED.. PRECISION.. ECONOMY



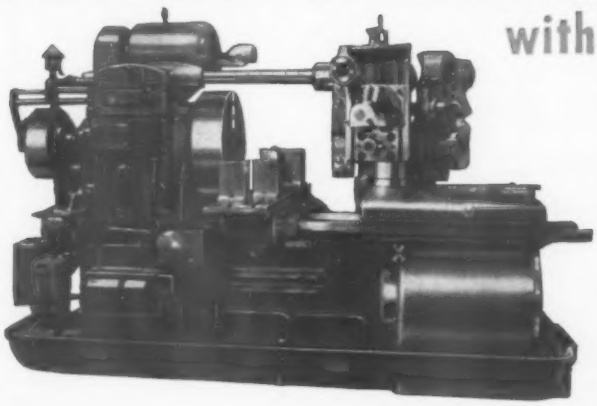




calls for a

POTTER & JOHNSTON 6-DRE *Automatic Turret Lathe*

with P & J TOOLING



Skillful P & J Tooling on the powerful P & J 6-DRE Automatic is a combination that adds up to increased output with high precision and lower production and labor costs on every type of work. In the set-up for the steel casting job shown above, the overhead pilot bar is equipped with a cam that operates a slide tool on the turret to obtain the angle with a single-point cut.

If you'd like to turn out your hard-to-machine jobs faster and better with fewer rejects and greater profits — try doing them the P & J way. Just do this: (1) Write today on your company letterhead for your copy of Bulletin No. 148 that contains ideas for the profitable machining of forgings, castings and cut-off bar stock, and (2) Ask the experienced P & J Tooling Engineers to help you. They'll be glad to recommend the best possible combination of tooling and operation sequence. There is no obligation.

Precision Tooling Production for over 50 years

POTTER & JOHNSTON COMPANY
PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY — DIVISION NILES – BEMENT – POND CO.

WRITE DIRECT OR CONTACT THE PRATT & WHITNEY BRANCH OFFICE NEAREST YOU
BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD
AGENTS: DALLAS, THE STANCO CO. • HOUSTON, WESSENDORFF, HELMS & CO.

Increased 6 Times...

On a SUNDSTRAND Rigidmil with Automatic Index Base

The Wetmore Reamer Company uses a Sundstrand model 33 Rigidmil to mill the cone angle and top of high speed steel reamer blades. Because of the power and rigidity of the Sundstrand Rigidmil the rate of feed has been increased 4 times over former method. Also with the new method of holding, 17 blades are milled in one pass as compared to 11 by the former method. In addition, use of an automatic index base and a power fixture provides free loading time and faster and easier operation.

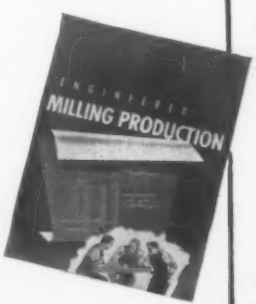
Features that Make Rigidmils More Productive

Over the past years there has been a constant improvement in productive design features on Sundstrand Rigidmils. These improvements are the result of our close work with industry in building efficient cost-cutting machinery to meet the ever present demands for progress. Some of the more important design improvements in Sundstrand Rigidmils are listed below. Check these against your present milling equipment.

1. **Wider Speeds**
   Every Rigidmil has a wide selection of feed rates to accommodate various types of metals.
2. **Wider Range of Feeds**
   to meet most production requirements in all types of metals.
3. **Larger Quills**
   are provided to facilitate carbide milling with greater horsepower.
4. **Heavier Heads For Greater H.P.**
   and to maintain greater accuracy at high production.
5. **Larger Working Areas**
   to hold more parts or longer parts in one cycle.
6. **Better Materials**
   used throughout all Rigidmils.
7. **Hardened Steel Ways**
   to insure consistent accuracy in machining.
8. **Climb Milling**
   to accommodate cycles where loading and unloading can be done while milling.
9. **Automatic Lubrication**
   to cut down maintenance costs, simplify operator's duties.
10. **Fast Rapid Traverse**
    to minimize non-cutting time of machine.
11. **Larger Coolant Supply**
    to accommodate long periods of production machining.
12. **Automatic Cycles**
    to minimize operator's duties and facilitate production milling.

FREE
Additional Data

This book will give you many suggestions for production milling methods. Standard, semi-standard and special machine applications to milling problems are described in detail. Write for your copy today. Ask for bulletin 723.



SUNDSTRAND

SUNDSTRAND
Machine Tool Company
2540 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

NEW!

SIMONDS

"WELD-EDGE"

Power Hacksaw Blade

It's Shatterproof!

Here's a Power Blade especially designed to meet all plant safety and performance requirements. A blade so tough it will not snap in operation regardless of abuse, neglect, worn machine condition or improper adjustment. A blade that has a high speed steel cutting edge that resists wear and is adaptable for all types of cutting.

With "Weld-Edge" there will be fewer blade-changes, longer blade life. This means more cuts per blade, higher output per machine and a definite reduction in production costs.

So for safety, dependability and increased output at lower cost, get SIMONDS "Weld-Edge" Blades from your Industrial Supply Distributor. All standard sizes available from stock.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon. Canadian Factory in Montreal, Que.
Southern Service Shop in Meridian, Miss. (formerly J. H. Miner Saw Mfg. Co.).
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

HE **"GUN" TAP**, the original spiral pointed tap, was developed by
EENFIELD to lick tap enemy No. 1, breakage due to chips clogging
the flutes. This problem is especially troublesome in "stringy" metals
ere the chip is long and curling.

Gun point solves the problem in through holes by causing the chips
shear and "shoot" out ahead of the tap.

some cases even blind holes can be tapped with the new Bottoming
Taps now furnished in machine screw and $\frac{1}{4}$"-$\frac{5}{16}$" sizes.

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

convertible self-opening die head

with aligning shank

GEO MET RIC **DS and DD** CLEVELAND

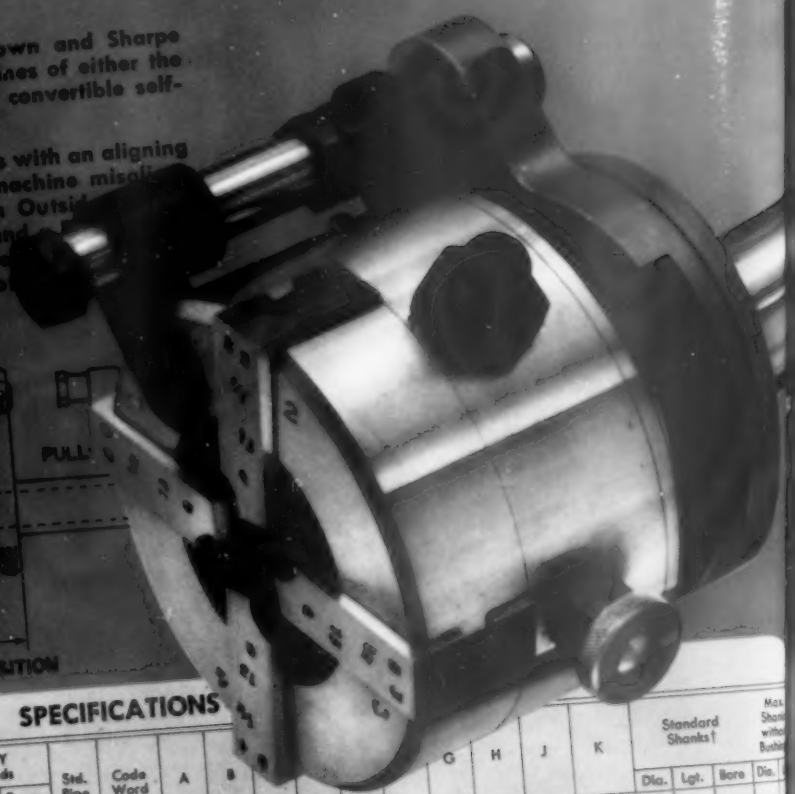
Bulletin DS 8 pages

Style DS

There is no better die head for use on Brown and Sharpe automatics, and for other small screw machines of either the automatic or hand type, than the improved convertible self-opening Geometric Style DS die head.

In the four smaller sizes, the DS now comes with an aligning shank which permits adjustment for any machine misali... ment. All sizes are equipped with both an Outsi... short length, fine pitch shoulder threading and ... for threading lengths providing ample chase... tripping. Conversion from one trip to the o... simple.

OUTSIDE TRIP POSITION



SPECIFICATIONS

	Style and Size Inches	MACHINE USED ON	CAPACITY Str. Threads Dia.	CAPACITY Str. Threads Lgt.	CAPACITY Str. Threads Coarsest Pitch	Std. Pipe	Code Word	A	B	C	D	E	G	H	J	K	Standard Shanks† Dia.	Standard Shanks† Lgt.	Standard Shanks† Bore	Max. Shank without Bushing Dia.
ALIGNING SHANKS	DS 5/16	00 and 00G-B. & S. Auto. 0-B. & S. Wire Feed & Hand	1/16 to 5/16	1¼	18	None	Desab Desac Desad Desae	1⅝	1¹¹⁄₁₆	½	1½	⅜	1⅛	1³⁄₁₆	Max. 1⁵⁄₃₂ Min. 5⁄₃₂	Max. 3⁄₁₆ Min. 0	10–32 N.F.	⅝ ¾ ⅞ 1 1⁄₁₆	1⁵⁄₁₆ 6 6 6	1½ Solid Solid Solid	⅜ * 1⅛
		Cleveland S.S.																¾	2⅛	½	⅜
	DS 3/8	0 & 0G-B. & S. Auto. 1-B. & S. Wire Feed & Hand	1/8 to 3/8	1⅜	12	1/8 to 1/4	Desaf Desag Desal Desam	2⅜	2¾	⅞	⅝	⅜	1⅜	1¹⁵⁄₁₆	Max. ⅝ Min. 1⁄₃₂	Max. 1⁄₈ Min. 0	12–28 N.F.	1 1 1⁄₁₆ 1¼	2½ 7 7	⅝ Solid Solid	1 * 1⅛
		Hand																			
		Cleveland S.S.																			
	DS ¼	2 & 2G-B. & S. Auto. 2-B. & S. Wire Feed & Hand	3/16 to 3/4	2¼	10	1/8 to 1/2	Desao Desap Desar	2⅞	2⅞	1⅛	1³⁄₁₆	⅝	1 1³⁄₁₆	2⅛	Max. ¾ Min. 3⁄₁₆	Max. 3⁄₁₆ Min. 0	¼–28 N.F.	1 1¼ 1½	2⅜ 7 7	1⅛ Solid Solid	1 * 1⅛
		Cleveland S.S.																			
	DS 1	2G & 2-B. & S. Auto** 2-B. & S. Wire Feed & Hand	3/8 to 1	2½	10	1/8 to 1/2	Desat Desav	3⅜	3⅛	1¼	1⅜	1⅛	2	2⅝	Max. ¾ Min. 3⁄₁₆	Max. 3⁄₁₆ Min. 0	¼–28 N.F.	1 1¾	2⅜ 3¼	1⅛ 1⅛	
		4-B. & S. Auto. 4-B. & S. Wire Feed & Hand																			
NON-ALIGNING SHANKS	DS 1¼	2 & 2G-B. & S. Auto. 2-B. & S. Wire Feed & Hand	13⁄₁₆–1¼	1¾	14	None	Deswa	2⅞	2⅝	1½	1⅝	⅝	1¾	2⅛	Max. 23⁄₃₂ Min. 11⁄₃₂	Max. ¼ Min. 0	12–28 N.F.	1	2⅜	None	
	DS 1¾	6-B. & S. Auto. 6-B. & S. Wire Feed & Hand	1½–1¾	2	14	None	Desya	3 11⁄₁₆	2⅝	2⅛	1 13⁄₁₆	⅝	2¼	2⅝	Max. ¾ Min. ⅜	Max. ¼ Min. 0	¼–28 N.F.	2	3¼	1⅝	

NOTE: Standard D Chasers used in 3⁄₁₆" and ¼" sizes. C Type Chasers used in larger sizes. †Special Shanks furnished at extra cost.
**Die Head modified with clearance to swing on machine. ‡Length that can be cut when shank is solid.
*Minimum Shank Diameter without shoulder is 5⁄₁₆" on 5⁄₁₆" DS, ⅞" on 9⁄₁₆" DS and 1⅛" on ¾" DS.

GEOMETRIC TOOL COMPANY DIVISION
Greenfield Tap and Die Corporation
NEW HAVEN 15, CONNECTICUT

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export distributor Bethlehem Steel Export Corporation

CARBON TOOL STEEL— Toolmakers' First Choice

So many tool steels have been developed for special applications that some people overlook the many uses for carbon tool steels. Actually they're used in larger quantities than any other type of tool steel. An experienced toolmaker usually considers them first, recognizing that they are the logical steels for a starting point.

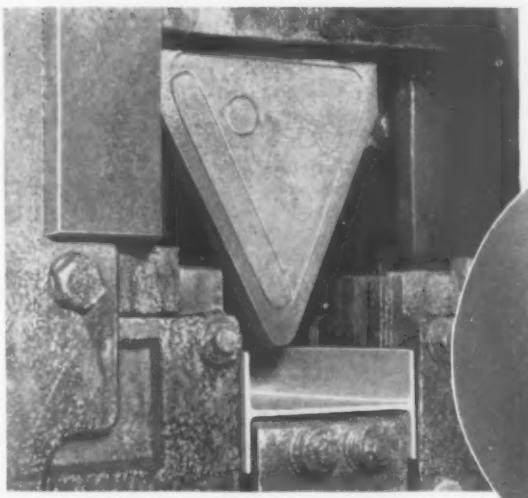
Here's why carbon tool steels are so popular:

- Easiest to machine of all tool steels
- Easy to heat-treat
- High surface hardness reinforced by a tough core
- They develop keen cutting edges

Hand chisels, center punches, and various shock tools are usually made from carbon tool steel having a carbon content of from 0.75 to 0.85 pct. Other ranges of carbon content: 0.90 to 1.00 for cold-heading dies; 1.00 to 1.10 for general-purpose tools and dies (this is the most frequently used analysis); and 1.15 to 1.25 carbon for stone-dressing tools, drawing dies, etc. Our carbon-vanadium steels, containing an addition of 0.15 to 0.25 pct vanadium, have similar applications in many instances.

The controlled hardenability and spheroidized structure of all Bethlehem carbon and carbon-vanadium grades assure uniform response in heat-treatment. Our extensive metallurgical research has established the ideal degree of hardenability for a wide range of applications. Your nearest Bethlehem distributor and our mill depot are at your service when you need top-quality carbon tool steel.

It's easy to machine this chamfering tool holder because all Bethlehem carbon tool steels are carefully spheroidize-annealed to provide a structure that's ideal for easy machining, easy heat-treatment.



After the triangular blade descends and shears a coupon from the web of the steel beam, it moves first to the left and then to the right to shear off the flanges. The lower knife is not visible.

The edge of this shear blade chipped because of misalignment which allowed it to strike the bottom blade. Heat-checking, caused by unexpected high temperatures, is also to blame for such failures.

When cold cuts make hot blades

The shear blades usually lasted about one week in a fabricating shop where steel beams and channels were cut in large quantities. Bad spalls on the cutting edges made it necessary to change blades about once a week, and it was taken for granted that little could be done to make them last longer.

One of our metallurgical men learned of this while in the shop on another job. He began to investigate and soon found that the "cold" cutting was generating about 700 F on the blades. This caused the tool steel to develop heat-checks. In addition, the blade was overloaded due to poor alignment which allowed it to strike the bottom blade. The combination of heat and overload explained the poor service life.

The solution: Hot-Work 8, one of our hot-work steels, was tried. It's an 8-pct molybdenum analysis that's tops in wear-resistance when operating temperatures are high. Tempered at 750 F, the first blade made a total of 45,000 cuts. The best previous record was 7,700 cuts.

Here's another instance of how the practical experience of our metallurgical contact men helps to put the finger on tool steel troubles.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Heat-treat the tool, not the thermocouple

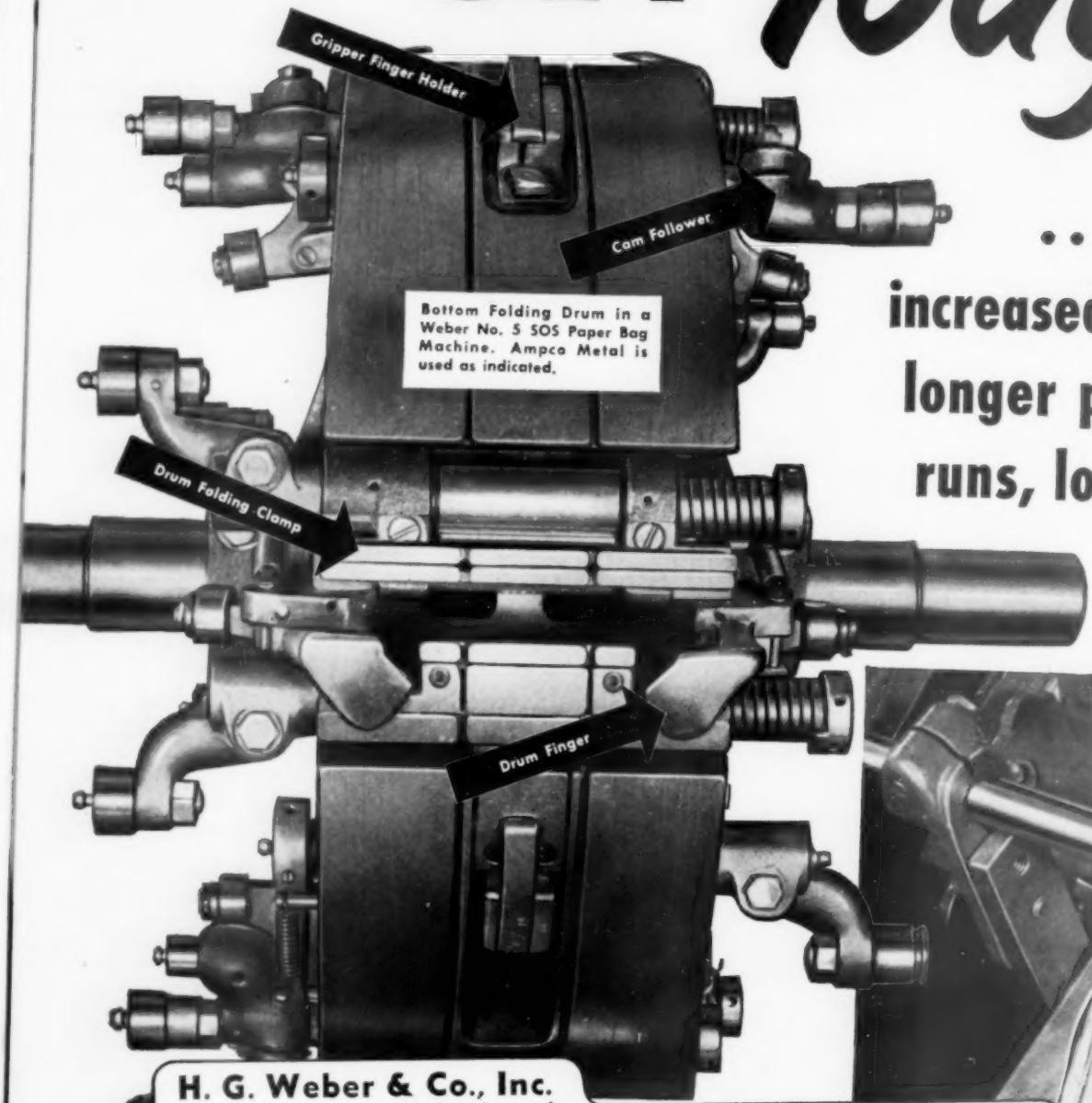
Improper temperatures during heat-treating frequently cause tool failures. In many instances the thermocouple chart shows proper heat-treatment temperatures, but the microstructure of the tool proves that the temperatures recorded were not attained by the tool. This is known as "heat-treating the thermocouple instead of the tool."

Most furnaces show some non-uniformity of temperature — locations near the source of heat are hotter than remote locations and the bottom tends to be colder than the top. A survey of each furnace will reveal the temperature differences which are present. This information makes it possible for the operator to select the location which will indicate most accurately the temperature of tools heated in the furnace; quite often the need for more than one thermocouple is apparent.

A thermocouple indicates the temperature of its tip only, so it's good practice to place the tip of the thermocouple as near to the tools as possible. Locations near the floor, sides, roof, or near the source of heat should be avoided. The thermocouple is an accurate and highly useful device, but it's not foolproof.

GET Tough

. . . insist o
increased part life
longer productio
runs, lower cost



Bottom Folding Drum in a Weber No. 5 SOS Paper Bag Machine. Ampco Metal is used as indicated.

Insert view shows com
ed bottom of bag being
and formed.

H. G. Weber & Co., Inc.
Kiel, Wisconsin

Product: Paper bag machine with capacity up to 300 bags per minute. Shown here is bottom folding drum and cam roller arrangement.

Application of Ampco Metal: Bottom folding drum is equipped throughout with Ampco castings for cam followers, drum fingers, opening cylinder fingers, drum clamps and center gripper finger holders. Cams are subjected to high shock load. Cam followers make cam contact 300 to 500 times per minute. Cam roller pressures . . . 35 to 40 lbs.

Results: Ampco Metal gives substantially longer cam life and reduces manufacturing costs by eliminating heat treating and grinding.

Ampco Metal increases part life by eliminating excessive wear on drum parts caused by abrasiveness of the paper.

IT'S PRODUCTION-WISE TO AMPCO-IZE!

Cam — Sand-cast.

Valve bodies — Sand-cast.

—use AMPCO* METAL

Bushing material—Centrifugally-cast Ampco Grade 18 bars, standard 12½" lengths.

Today's production schedules are demanding. They call for machines that are tough — machines that can take it hour after hour, day after day, month after month.

Designers and plant operating men are using Ampco Metal to build this extra toughness, longer life into their products and equipment.

Here's why: Ampco Metal has high compressive strength — doesn't squash out. It resists abrasion, corrosion and erosion. These properties plus high impact, high fatigue values and excellent bearing qualities make Ampco Metal ideally suited for the toughest kind of service.

You can get Ampco Metal in a variety of forms —sand and centrifugal castings, bars, forgings, sheet, plate, tubes, arc welding electrodes and wire, etc.

Enjoy higher production, freedom from trouble in both product and plant — use Ampco Metal. Your nearest Ampco field engineer is glad to help you on any application. Consult him or write us for additional information.

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

Clutch ring — Centrifugally-cast.

Tear out this coupon and mail today!

Ampco Metal, Inc.

MILWAUKEE 46, WISCONSIN

West Coast Plant

BURBANK, CALIFORNIA

AMPCO®

AMPCO METAL, INC., Dept. TE-9, Milwaukee 46, Wisconsin

Send me your free Ampco Metal literature giving descriptions and general applications of Ampco Metal.

Name.....Title.....

Company.....

Company Address.....

City.....(.....) State.....

D-10

UNION TWIST DRILLS are made in the broadest range of types, to cover every drilling operation — no matter what your material or drilling equipment may be.

For fast, free-cutting performance, minimum breakage and more work between re-sharpenings, see your Union Distributor for the drills that are *right* for *you*.

FIRST TEAM IN CUTTING TOOLS . . .

UNION *and your* Local Distributor

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS • Milling Cutters • Gear Cutters • Twist Drills • Hobs • Reamers • Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers, Twist Drills . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates

. . . CAN YOUR SURFAC

"Our DoALL Grinder is 50% faster than previous machine and tool life is increased 30% because of better finish", says Reltool Corporation, Milwaukee, Wisconsin.

Rigid DoALL Surface Grinders Can Take Heavier Cuts and Produce Precision Work Faster

TRY THE TEST illustrated at the right. Take the heavy cut, reverse the crossfeed and let the wheel run back over the ground surface. If it sparks it is grinding again, showing that the wheel didn't take the full depth of cut on the first pass. If it is a DoALL Grinder it won't spark; in fact, if you stop the work under the wheel and shut off the motor the wheel will coast to a stop without touching the work surface.

Now, pencil mark the work surface. Lower the wheel .0001", start the grinder and the wheel will erase the pencil mark.

There is proof of the rigidity and precision of a DoALL Grinder! There is why it will do a given job in less time. You can take a heavier cut without "give" in the spindle or the table. The wheel doesn't climb over the work piece—it cuts true in one pass. There is no back-lash, slop or hang-up in the vertical column—you can control the vertical feed to lower the wheel as little as .0001" even after a heavy cut.

And, with DoALL "Cool-Grinding"* you can take full advantage of this rigidity and precision—take the heavier cuts without burning the work—get a better finish and sharper edges. Coolant flows in at the hub, *through* the wheel and out *at the point of contact* in a fine mist. There is always coolant where the heat is generated, unlike flood cooling where the wheel blasts the coolant away from point of contact.

There is a DoALL Surface Grinder with hand or hydraulic crossfeed for every toolroom or production requirement. Call your local DoALL Sales-Service Store today or write:

THE DoALL COMPANY

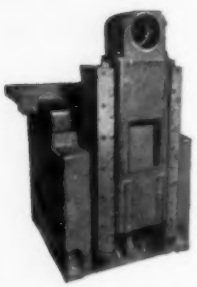
254 N. Laurel Ave., Des Plaines, Illinois

35 Local Sales-Service Stores in North America

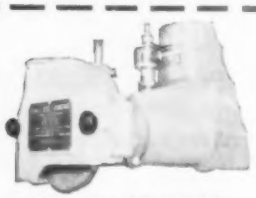
* U.S. Patent No. 2470350. Available as extra equipment on all DoALL Surface Grinders.

GR-6

HERE'S WHY DoALL PRECISION HYDRAULIC SURFACE GRINDERS ARE FASTER, MORE RIGID, MORE ACCURATE!



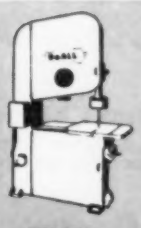
MASSIVE FRAME —column support and base are single-piece chrome nickel steel casting, strongly ribbed for great rigidity.



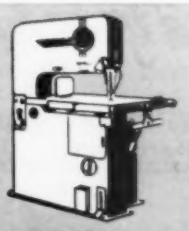
HUSKY SPINDLE SUPPORT, dowelled and bolted to column, prevents wheel from chattering or springing away from work.

VERTICAL FEED INCREMENTS .0001"—made possible by ridigity and precision of ext... long 30" column.

CONTOUR-MATIC



ZEPHYR

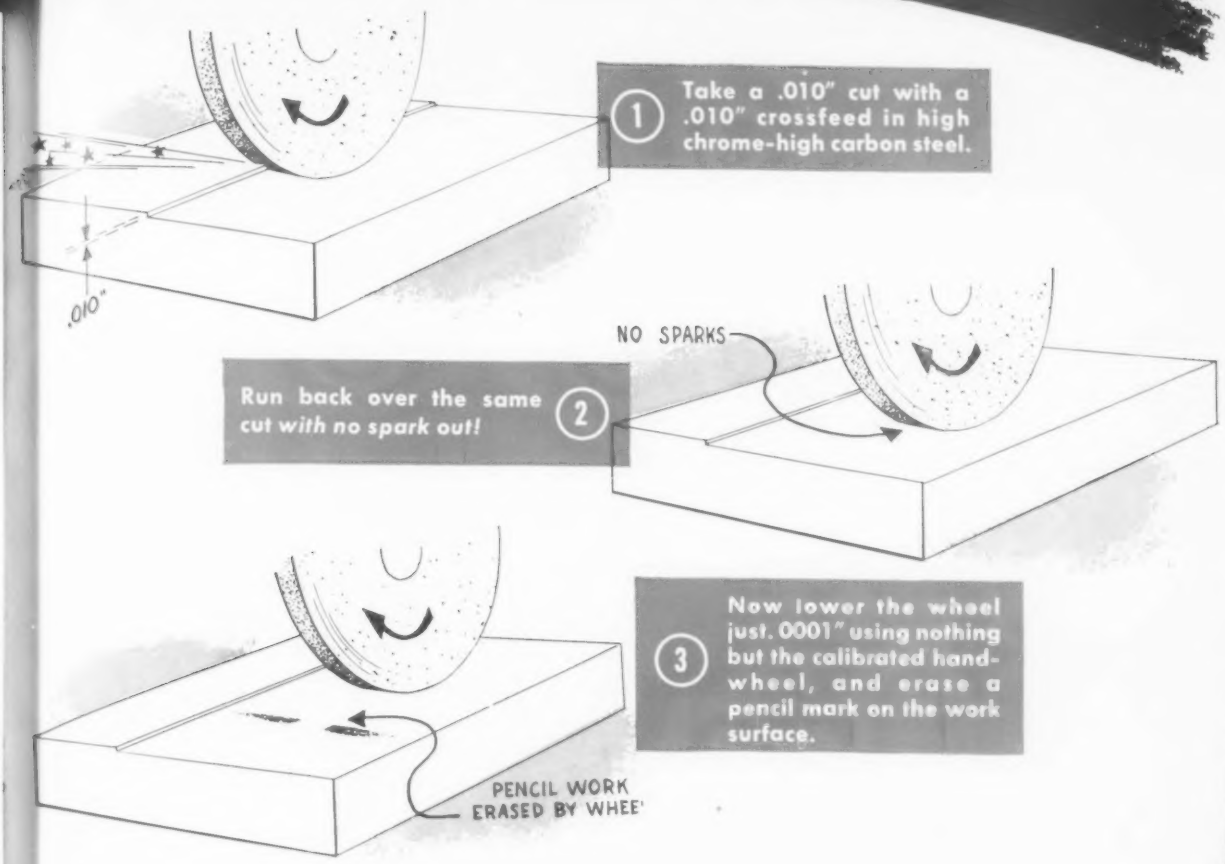


CONTOUR

BAND FILER

SAW BANDS

INDERS DO THIS?

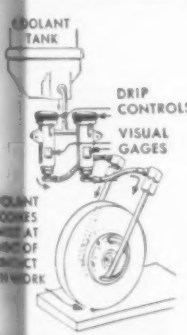


1. Take a .010" cut with a .010" crossfeed in high chrome-high carbon steel.

2. Run back over the same cut *with no spark out!*

3. Now lower the wheel just .0001" using nothing but the calibrated handwheel, and erase a pencil mark on the work surface.

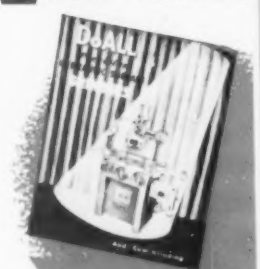
You can see the above test as part of a complete demonstration of a DoALL Precision Surface Grinder right in your own plant, without cost or obligation. Call your local DoALL Sales-Service Store today.



"COOL-GRINDING" ATTACHMENT—reduces cutting temperature as much as 400°F; prevents burning, warpage, checking, skin softness.

FULL HYDRAULIC *DRIVE* of table and crossfeed, not merely a hydraulic *control* of a mechanical drive. Smoother, longer-wearing, quieter; more uniform motion for smoother finish, greater precision.

DoALL



Ask for Descriptive Bulletin


TOOLROOM GRINDER


CRUSH GRINDER


GAGING EQUIPMENT


MONOLITE


MOBILE INSPECTION UNITS


TOOL STEEL

Only Lucas CAN MAKE A LUCAS

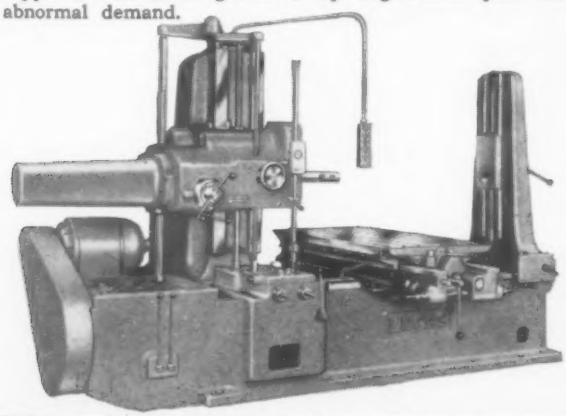
. . . but others are lending a hand

This is one of America's outstanding plants of its kind, and every tool in it is there for the production of Lucas Horizontal Boring, Drilling and Milling machines. This specialization means a greater output of critically needed machines for the defense program.

Thousands of man hours of exclusive experience on Lucas mills enable us to keep quality abreast of quantity.

Many an outside supplier is working 'round the clock on component parts to supplement our own efforts. Final assembly and inspection is still carried on in our own plant.

We still have to keep many a loyal customer waiting, because our output like that of all other defense machine suppliers has been governed by regulations plus an abnormal demand.



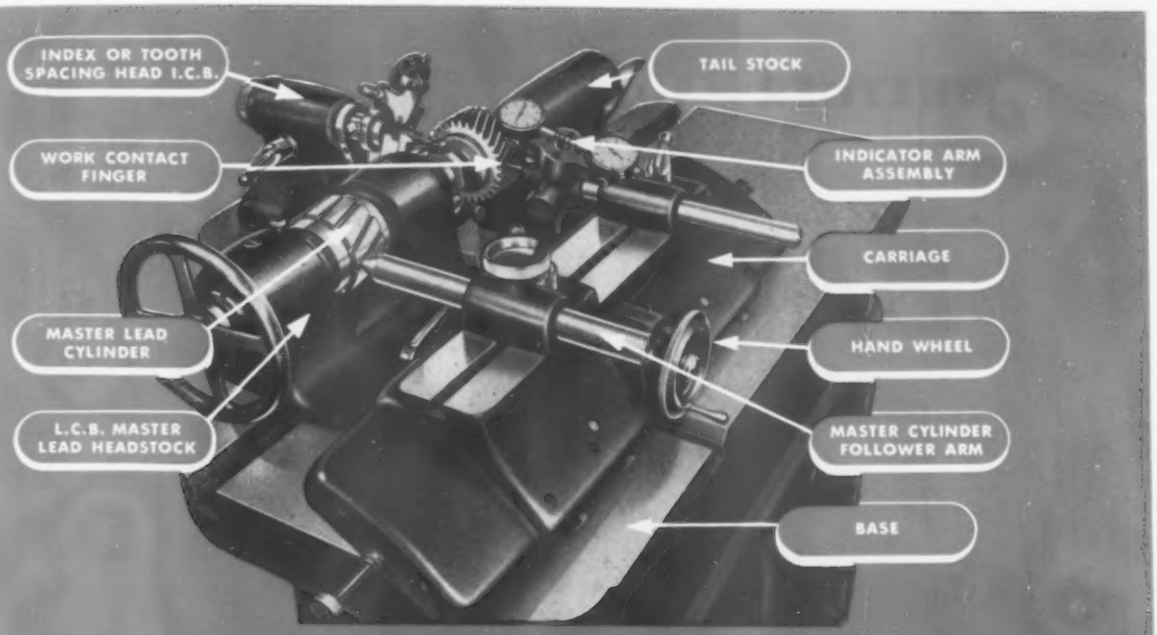
Your inquiry and your order are still as welcome as ever. When you do get the Lucas you need you'll find it your No. 1 money maker – the most used machine in the shop.

THE NEW BRITAIN LUCAS CLEVELAND MACHINE COMPANY

LUCAS

Precision

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO



Red Ring Lead Comparator—slide assembly on the right of the work centers with the I.C.B. index or tooth space checking head on the other side.

LOCATE AND EVALUATE GEAR ERRORS

QUICKLY and ACCURATELY

Errors in each of the several gear characteristics can be quickly analyzed and evaluated on the Red Ring Universal Gear Checker.

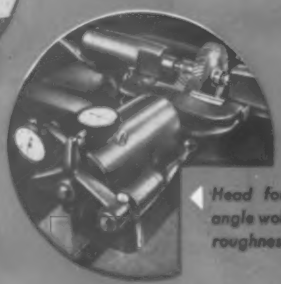
This instrument with 5 interchangeable heads indicates errors in tooth size, spacing, helix angle, lead, eccentricity, parallelism and wobble. This Checker is rugged enough for the production shop—sensitive enough for the gear laboratory—simple enough for the average shop man to use effectively. No special skill is required—ideal for the rapid inspection of mass-produced gears.

For more detailed information and specifications ask for Bulletin C-51-6.

Model SIC Head checks helix angle eccentricity and tooth size.

Model ECA Head checks eccentricity and tooth size.

Model CPA Head checks parallelism.



Head for checking helix angle wobble, eccentricity, roughness of roll and size.

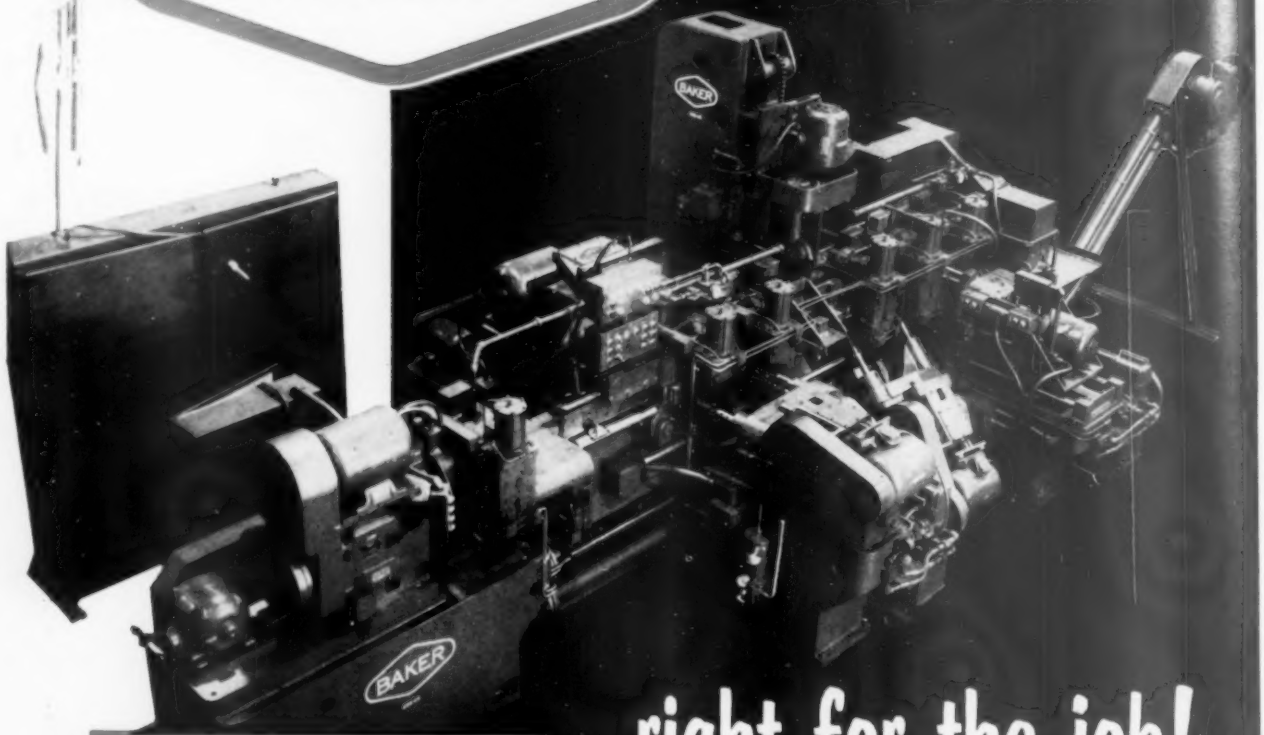
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

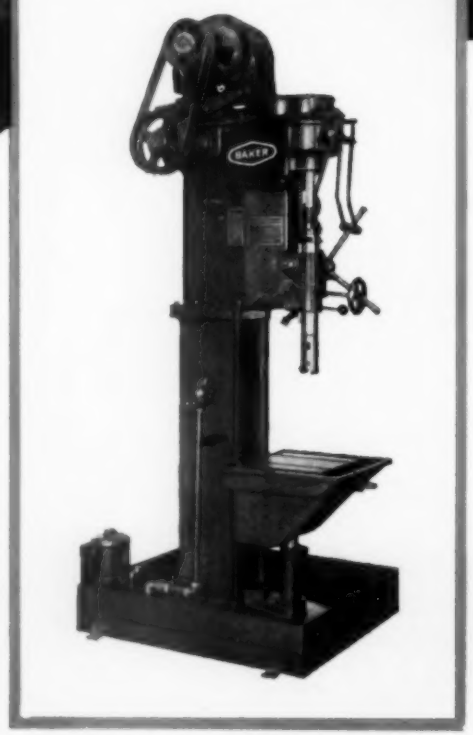
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

WHETHER LIGHT or HEAVY..
STANDARD or SPECIAL

BAKER has the drill..

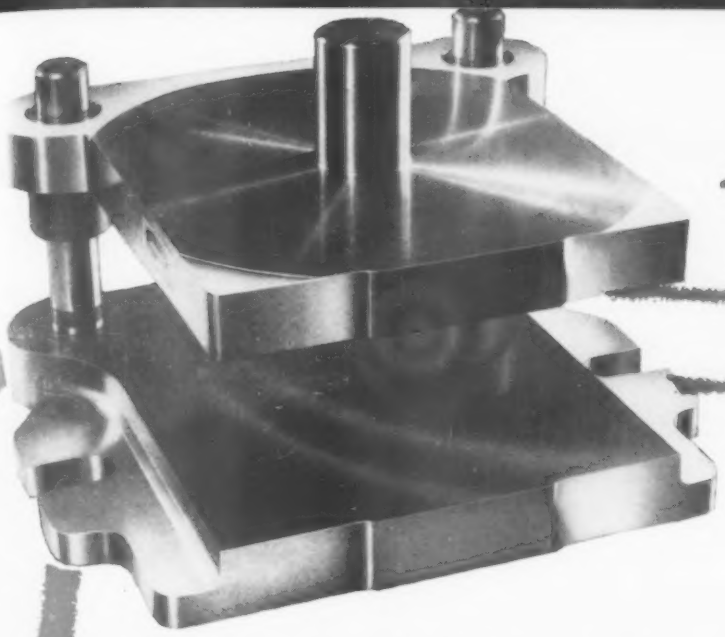


..right for the job!



Regardless of the job requirement, Baker engineers have the know-how to provide drilling machines that will do the job better! Where production figures are of primary importance, Baker will greatly increase productivity . . . and for standard drills over inch and a half capacity . . . there's a Baker *right for every job.* Consult Baker for better drilling machines, no obligation . . . and there is a qualified Baker Sales and Service Representative nearby who is eager to give you prompt and efficient service.

BAKER BROTHERS, INC. Toledo, Ohio
DRILLING...TAPPING...KEYSEATING and CONTOUR GRINDING MACHINES

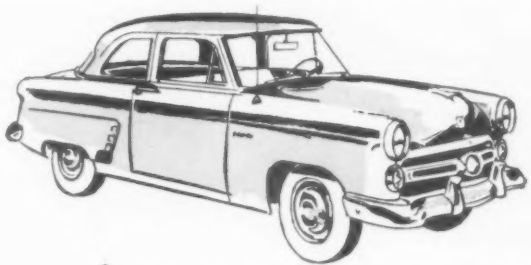


DANLY DIE SETS

helped FORD retool for '52

Somewhere behind the scenes in almost every outstanding mass production operation, you'll find Danly Die Sets at work . . . saving time in the die shop and assuring longer production runs in the press room. Danly Die Sets are the first choice of diemakers everywhere.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50, Illinois



Get your DANLY DIE SETS from your conveniently located DANLY BRANCH ASSEMBLY PLANT

***CHICAGO**	50	2100 South Laramie Avenue
***CLEVELAND**	14	1550 East 33rd Street
***DAYTON**	7	3196 Delphos Avenue
***DETROIT**	16	1549 Temple Avenue
***GRAND RAPIDS**		113 Michigan Street N.W.
INDIANAPOLIS	4	5 West 10th Street
***LONG ISLAND CITY**	1	47-28 37th Street
***LOS ANGELES**	54	Ducommun Metals & Supply Co. 4890 South Alameda
MILWAUKEE	2	111 East Wisconsin Avenue
***PHILADELPHIA**	40	511 W. Courtland Street
***ROCHESTER**	4	16 Commercial Street

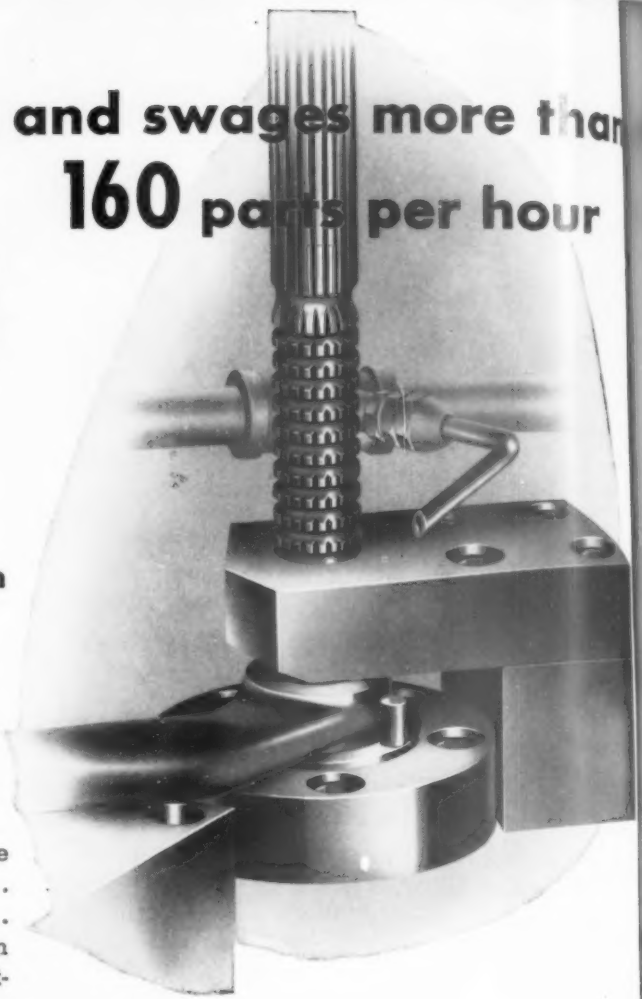
**Indicates complete stock*

DANLY®

DIE SETS AND DIEMAKERS' SUPPLIES

2 operations in 1 pass

broaches and swages more than 160 parts per hour



Accuracy and power combined on an American 25 ton press —

1. *Broaches 32 serrations in a 7/8" diameter hole in a Pitman arm.*
2. *Swages the serrations to a 3/4" taper per foot.*

Your next broaching problem can be solved more economically by broaching the American Way . . . because American designs and builds all three . . . broaches, machines and fixtures. To start American engineers working on your problem, send a part-print or sample and hourly requirements. *Write today for Circular No. 300.*

The broaching stroke is started by manual control. The broach and swage assembly is held in accurate alignment by twin guide posts built integral with the broach push head. The 32 serrations are broached and then swaged under 25 tons pressure in one pass. On the return stroke, the broach is stripped from the part by a plate in the fixture.

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

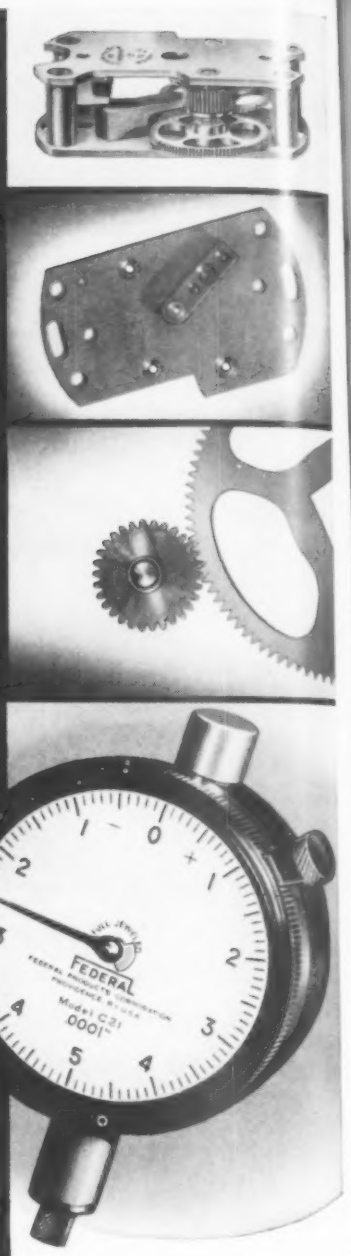
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

ALLEN ⬡ SCREW . . . SOCKET SCREW

mean the same thing everywhere!

Although *Allen ⬡ Screw* is not in the dictionary, engineers and production men the world over say *Allen ⬡ Screws* to refer to *precision socket screws.* That's how it is with names — probably there's a name that comes to your mind at once as an outstanding *Industrial Distributor* in your locality. He is almost certain to be the one who handles *Allen ⬡ Screw* products. His experience and extensive stock of Allen ⬡ products are the ideal combination to smooth out any problems you encounter in precision fastenings.

THE **BUY** WORD IN SOCKET SCREWS IS **ALLEN**



The Dial Indicator Built as Fine as the Finest Watch

Today the Dial Indicator is built mechanically as fine as the finest watch, for years the standard of comparison for fine manufactured articles.

The distance the contact point of a Dial Indicator moves must be accurately magnified by its rack and gears so that the amount of this distance will be accurately indicated by the dial graduations.

Gear teeth must be so designed and precisely cut they will magnify the movement of the contact point accurately and positively. All bearings and bushings must fit precisely so there is no lost motion and yet they cannot fit so tightly as to cause excessive friction. Inertia must be held to a minimum. All these details are necessary if a Dial Indicator is to be sensitive to slight dimensional variations.

A Dial Indicator must have exceptional fidelity in order to always "repeat" the same reading for the same amount of variation.

And, finally, a Dial Indicator must have the stamina and durability to withstand sudden shock and rough abuse.

At Federal Products Corporation we are constantly aware of the importance of these requirements. Federal leads in the development of Low-Friction, Low-Inertia, Full-Jeweled Indicators. Federal's top and bottom movement plate construction has long defied improvement and Indicator maintenance men prefer it to all others.

Send for Federal's latest catalog showing the most complete line of Dial Indicators and Indicating Gages. FEDERAL PRODUCTS CORPORATION, 1199 Eddy Street, Providence 1, Rhode Island.

ABOVE ILLUSTRATIONS
(Top to Bottom)

Note rigid assembly of top and bottom plates and massive support for pinion bearing — features which mean long lived accuracy.

•

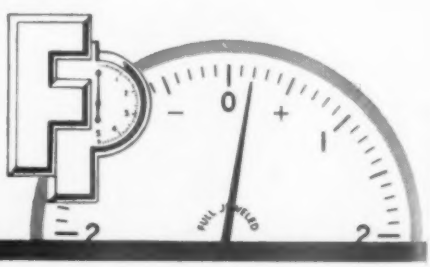
Bottom plate of heavy gage brass showing jeweled bearings and precision workmanship.

•

Teeth of gears and pinions are cleanly cut — not stamped — and they mesh accurately.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES



TYPICAL HYDROFORMED PARTS

A major advance in metal forming

NEW CINCINNATI

CINCINNATI 12" HYDROFORM

Cincinnati Hydroform machines are now available in five sizes, capable of handling blanks 12", 19", 23", 26", and 32" in diameter. Maximum depth of draw ranges from 7" on the 12" machine to 12" on the 32" machine. Information on larger machines furnished on request.

NEW HYDROFORM BULLETIN

For a complete description of Hydroforming — tooling details, operation, examples of Hydroformed parts, machine dimensions and specifications —write for your copy of Bulletin M-1759.

Hydroform

THE CINCINNATI MILLING MACHINE CO
CINCINNATI 9, OHIO

Hydroform

simplifies deep drawing . . . brings to deep drawing many advantages over other metal forming processes!

Hydroforming has revolutionized deep drawing. Practically any shape can be drawn from a wide variety of materials up to 3/8" thick. Most parts can be Hydroformed in a single operation. Tool costs are reduced up to 90%. Part quality is materially improved.

HYDROFORM TOOLING

The Cincinnati Hydroform eliminates the conventional and costly mated punch and die assembly. (See diagram "A".) An oil cavity, sealed by a flexible die member, serves as a universal die and upper blank holder.

Tools consist of a punch of the desired shape, and a draw ring contoured to fit around the punch. Tools are self-centering; self-aligning.

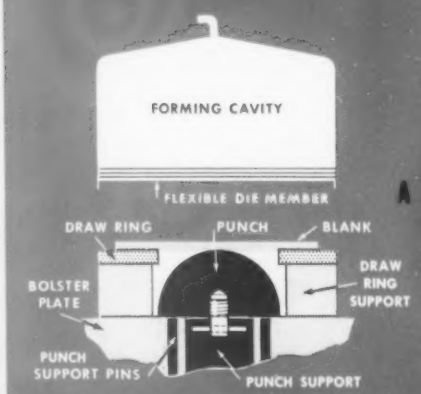
HYDROFORM OPERATION

In Hydroforming the part (see diagram "B"), the blank is placed on the draw ring and the flexible die member is lowered and locked in position. Pressure in the cavity is established at a predetermined setting. The punch is moved upward, forcing the flexible die member and blank to take the shape of the punch. The metal is uniformly shaped with a minimum of stretch or strain in the formed areas. Thin-out and spot stresses are virtually eliminated. Springback is reduced. Surface finish is unimpaired.

One Hydroform user says Hydroforming "represents the most notable advance in metal forming in twenty-five years." And many other manufacturers are now utilizing the far-reaching advantages of Hydroforming —producing such diversified items as

Hollow-ware • Ordnance and Aircraft Parts
Radio, Radar and Television Components
Appliance and Automotive Products • Many Others

Hydroforming has enabled these manufacturers to produce an improved part—in far fewer operations—at tremendous savings in tooling, labor and material costs. It has changed their thinking on deep drawing and forming. Investigate Hydroforming for your production.



CINCINNATI

Save ¾ the investment and ⅔ the floor space

Double all production estimates

Airfeedrills

IN A MULTIPLE DRILLING FIXTURE

MANUFACTURER: Name on request

PROBLEM: Drill twelve accurate holes in half a million 24ST aluminum parts

CONSIDERATIONS: Large investment uneconomical because of limited demand. Shop floor area at a premium

SOLUTION: A fixture with eight Keller Airfeedrills, four with dual spindles

PRODUCTION ESTIMATES: Up to three hundred parts per hour

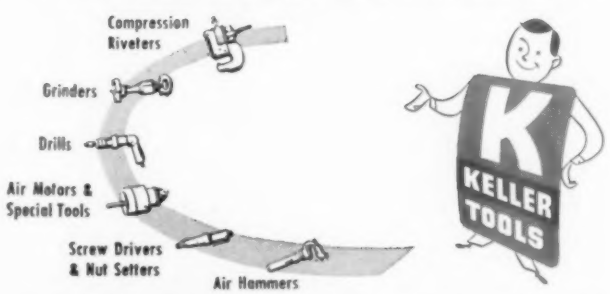
PERFORMANCE: Sustained production of six hundred or more parts an hour—five thousand per 8-hour day

FEATURES

- Accurate holes without costly fixtures
- Attaches in any position at any angle
- Operates entirely by air
- Used in tight places or close centers
- Wide range of speeds and strokes
- Detachable to shift from job to job

KELLER

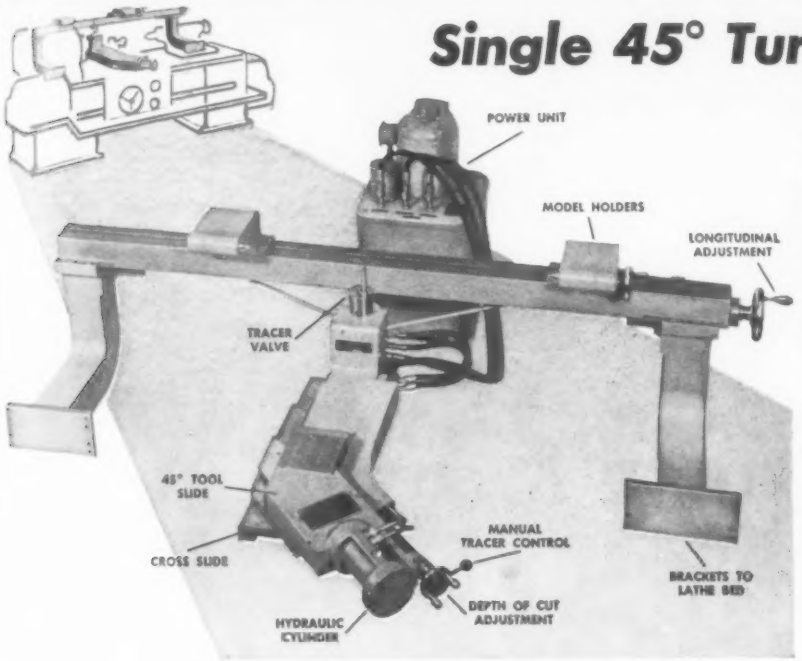
Pneumatic Tools



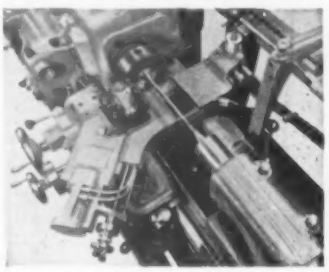
KELLER TOOL COMPANY, GRAND HAVEN, MICH.

Convert your standard lathes to produce more jobs, faster, better with Turchan hydraulic duplicators

Single 45° Turchan Attachment

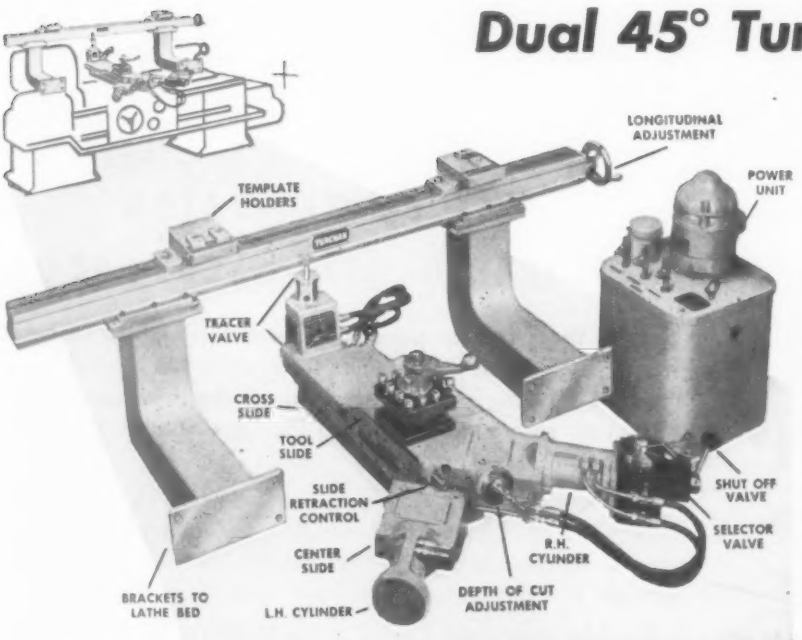


Aircraft, armament and civilian plants report 4 to 6 times more production of parts with Turchan equipment. This method duplicates work shapes from a model or template by means of hydraulically controlled tools taking uninterrupted cuts over the work. The attachment replaces the regular cross slide, operating at a 45° angle. Special form tools and skilled help are not required. Job set-up time becomes a matter of minutes.

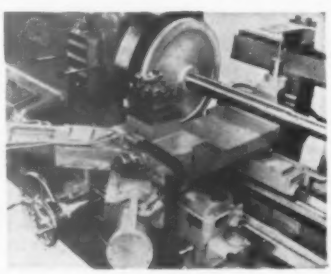


Whether turning a delicate valve stem or a large mill roll, the Turchan automatically duplicates it faster, more accurately.

Dual 45° Turchan Attachment



This twin slide arrangement *doubles* tool approach to the work. Right or left square shoulders, bevels, tapers, steps, undercuts, radii, and intricate contour facing is done with the ease of simple turning. Faster, more accurate work, to .001 variation, with fine surface finish, results in tremendous savings. Any size, make or model standard lathe can be equipped with the Turchan duplicating attachment. "Turn to Turchan to cut costs."



The dual slide duplicator machining a jet engine part, turns shaft and faces disc in a single set-up, to close tolerances.

WRITE US TODAY: Send a sketch and specifications of any job. Give make of machine. We'll show you how to produce it better, faster, at lower cost.

NEW CATALOG
Write for 20-page illustrated booklet showing how Turchan can cut your production costs.

Turchan FOLLOWER MACHINE COMPANY
8259 LIVERNOIS AVENUE DETROIT 4, MICH.

A NEW ASSEMBLY PLANNING AID

FOR DESIGN, PROJECT, STANDARDS, AND METHODS ENGINEERS, AND PRODUCTION OFFICIALS CONCERNED WITH ASSEMBLY

The PARKER-KALON ENGINEERING STANDARDS BOOK

Here is the assembly planning reference book you've been waiting for. Already thousands of requests for it have been received. Making sure it contained *all* the information you want took somewhat more time than anticipated, but your copy is ready now.

This new edition is set up to help you find the facts and figures you need faster than ever. It gives complete head and thread dimensions on all P-K standard screws, and many specials. It's also packed with other useful information.

Send for your copy. Look it over. You'll see why the many types in the complete P-K line of Self-tapping Screws enable you to *fit the right fastener* to the job, not fit the *job* to some one type of *fastener*.

It's available to all authorized assembly planners. Send your request on your company letterhead. Write today. Parker-Kalon Corporation, 200 Varick St., New York 14.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

Cold-forged **SOCKET SCREWS**

AND OTHER FASTENING DEVICES

In Your Cylindrical or Centerless Grinding...

Grinding a large cylindrical part to exact tolerance and degree of finish. The Norton range of specifications enables you to select exactly the right wheel for work like this.

A plunge-cut grinding job to a shoulder on a centerless machine. Units being ground are textile machinery parts, for which wheels of Norton ALUNDUM* (fused alumina) in the correct grain size and grade, give best results.

Shaping a wheel by crush truing, with hardened steel crushing roll shown in raised position. Both Norton ALUNDUM and CRYSTOLON* wheels can be crush trued, to give excellent results in this rapidly growing method of grinding intricate O. D. contours.

HANDY ILLUSTRATED BOOKLET gives you the essential facts on cylindrical and centerless grinding and provides convenient selection charts. Ask your Norton Distributor for Form 2006. Or write direct for free copy. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities.

It's easier to

GET MORE UNITS

per dressing • per hour per wheel

WITH NORTON O. D. GRINDING WHEELS

You want your cylindrical or centerless grinding wheels to deliver exactly the required tolerances and finish . . . in piece after piece . . . hour after hour . . . with a minimum of dressing or replacement.

With Norton wheels it's *easier* to get these results. Here are the reasons:

1. Norton Range of Specifications Covers All Your O. D. Jobs. Whatever your material or job specifications — in the complete line of Norton wheels for O.D. grinding you're sure to find the *one* wheel with the *right* combination of abrasive grain type and bond for top cutting performance and extra long wheel life — and Norton uniformity assures top performance in *every* wheel.

2. Norton Applicational Aid Covers Your Grinding Problems. In practically every case your Norton Distributor can quickly tell you which types of wheels you need. Backing him is the Norton Abrasive Engineer in your area. And behind both is the Norton technical staff, representing the resources and know-how of the world's largest manufacturer of abrasives.

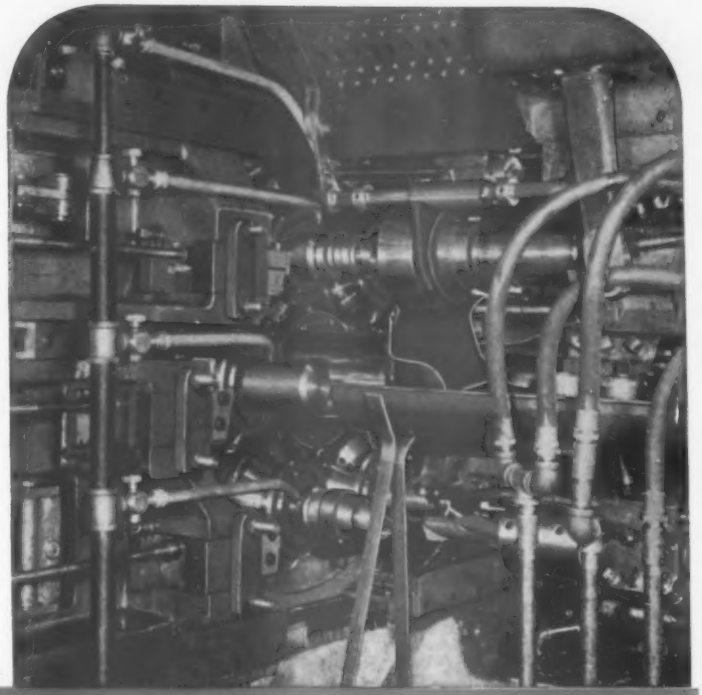
3. Norton Stocks Cover Your Delivery Requirements. Your Norton Distributor keeps ample stocks of popular O.D. wheel types and sizes. Larger stocks are maintained in Norton warehouses in key cities throughout the country, and you can always count on prompt shipments from Norton Company's complete stocks in Worcester.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

Making better products to make other products better

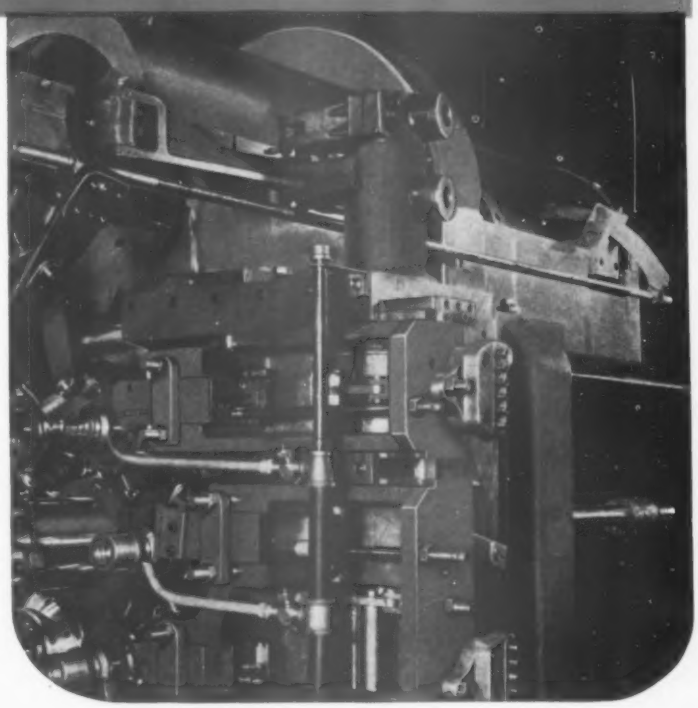
The main end slide of a 3½-SIX figures prominently in producing the above piece. Its total length is 34½ ins. Its diameter is 12 ins. Its swing for die heads, etc., is 4 ins. The maximum recommended load for the slide is 12,000 foot pounds. Its bearing area is approx. 258 sq. ins.



Front Side of Tooling Area

BETTER BEFORE THAN AFTER

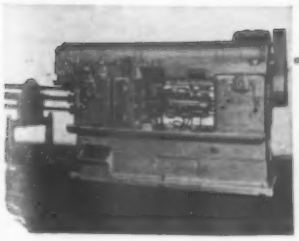
Rear Side of Tooling Area



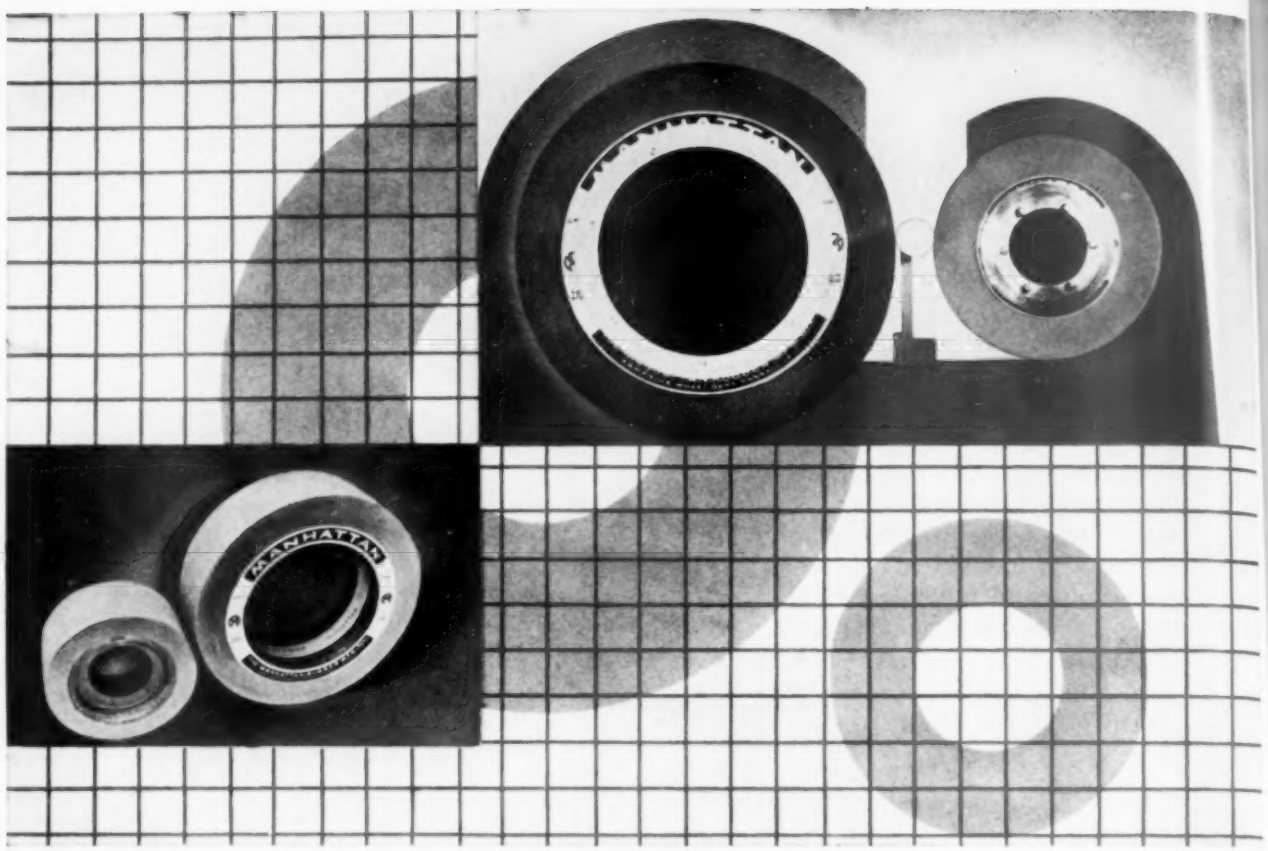
What an "automatic" does *after* it goes into production is information for which you have already paid a purchase price. How much more you will pay for operation and maintenance costs will determine the completeness and dependability of that information.

It is always better to have complete and dependable information *before* the purchase than after. You can have it on CONOMATICS.

A Comparison of ALL Automatics is in favor of Cone



Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.



MANHATTAN CENTERLESS WHEELS

custom-made for faster production

The surest way to get more metal removal per pass is to have the abrasive and bond custom-tailored to the work you are doing. That's how Manhattan Centerless Wheels are made – to *your* order. In addition, Manhattan Centerless Wheels perform two operations – roughing and finishing – without necessity of changing wheels. Higher metal removal, longer wheel life, and savings in centerless wheel inventory add up to a substantial economy in your production costs – worth looking into!

Manhattan Regulating Wheels are supplied either plain or core-mounted at additional worthwhile savings.

CRUSHING WHEEL INSTITUTE MEMBER

WRITE TO ABRASIVE WHEEL DEPARTMENT

R/M

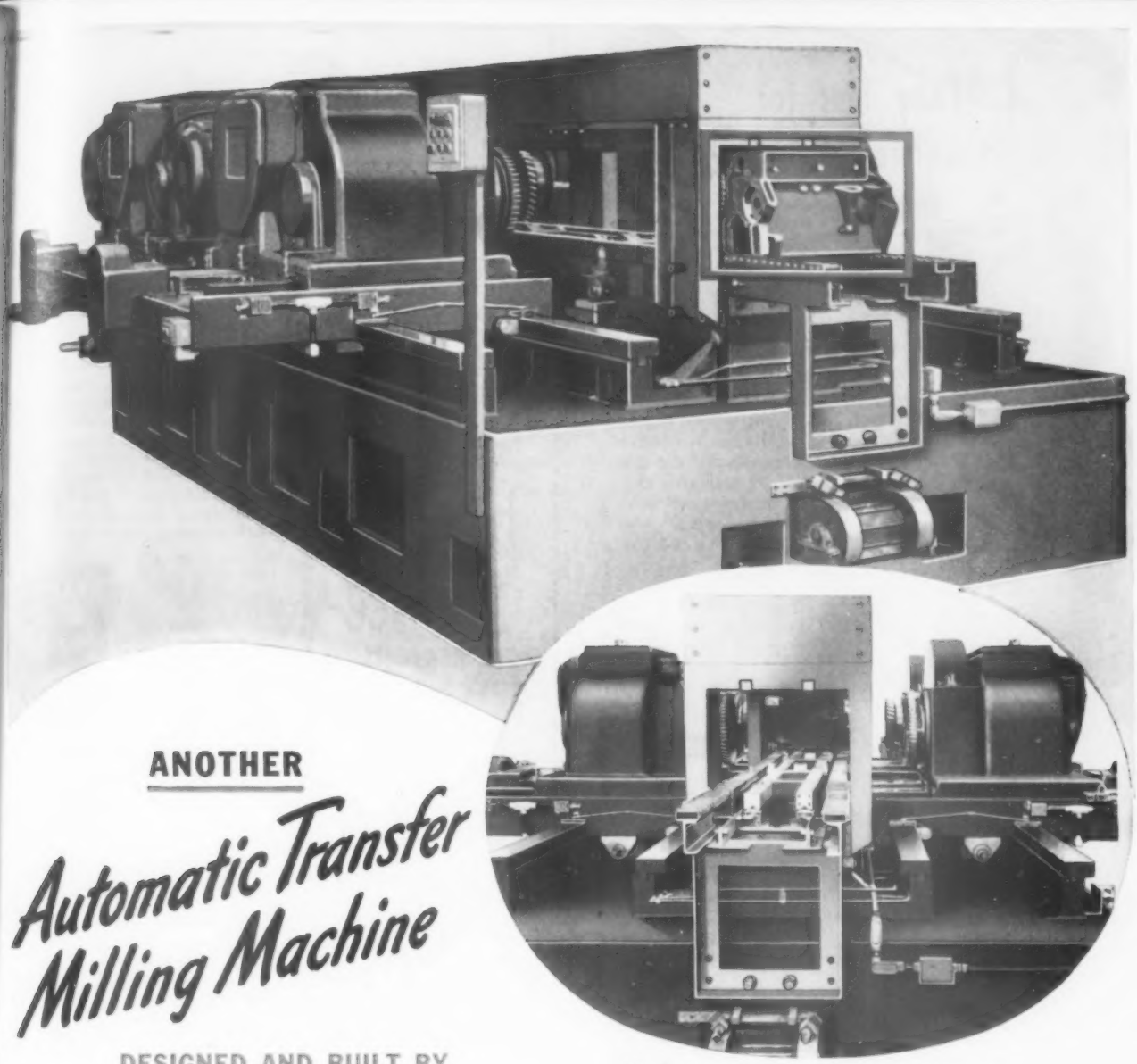
MANHATTAN RUBBER DIVISION – PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Flat Belts · V-Belts · Conveyor Belts · Hose · Roll Covering · Tank Lining · Abrasive Wheels

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

MR-825



ANOTHER

Automatic Transfer Milling Machine

DESIGNED AND BUILT BY

MOTCH & MERRYWEATHER

End view showing transfer mechanism and 75 h. p. milling heads in retracted, accessible position.

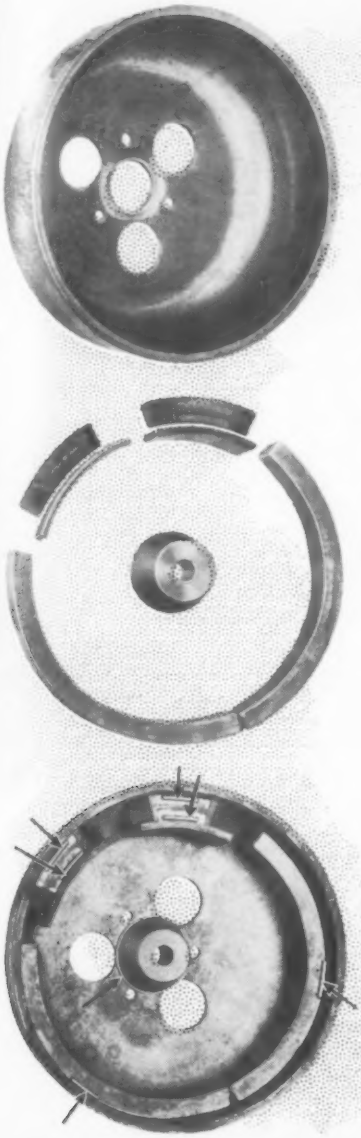
to Rough-Mill and Finish-Mill Both Ends of Automotive Cylinder Blocks

• Cylinder blocks are fed to the machine, transferred from station to station, and discharged to the next operation. This machine forms an important link in a completely automatic production line.

Manufactured by —THE MOTCH & MERRYWEATHER MACHINERY CO.—
CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Automatic and Special Machines

PRODUCTION-WITH-ACCURACY • MACHINES AND EQUIPMENT



YOUR LOW-COST WAY TO HIGH-STRENGTH METAL ASSEMBLIES

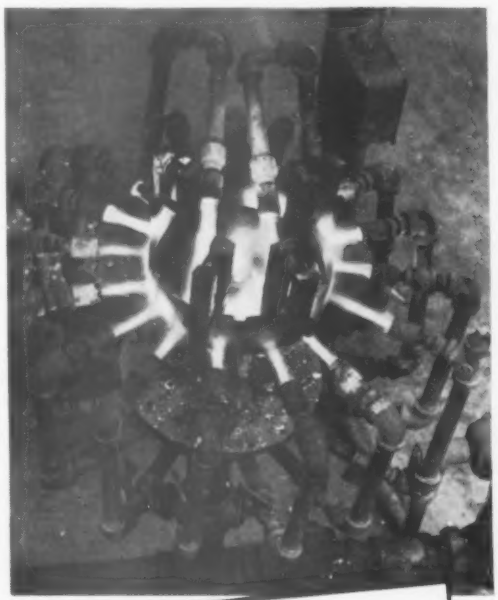
...braze with EASY-FLO

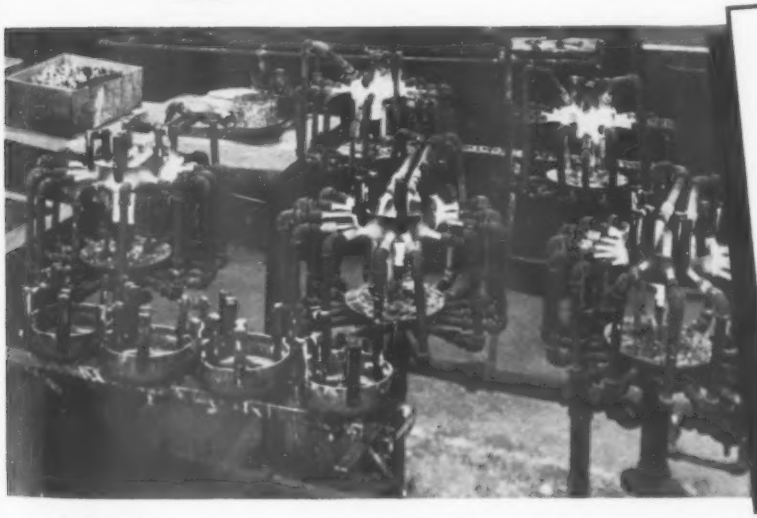
IT'S EASY-FLO'S combination of low flow point, exceptional fluidity and deep, instantaneous penetration that does it — the reason why this low-temperature silver brazing alloy just naturally produces high tensile and impact strength joints at a surprisingly low cost per joint. Here's a typical example — from R. E. Phelon Co., Inc., East Longmeadow, Mass. — a flywheel magneto —formerly a costly non-magnetic casting — now an economical EASY-FLO brazed assembly, strong as solid metal.

MAGNETO PARTS — *Above* — the Shell, a mild steel stamping. *Left* — a steel Hub — 2 steel Counterweights — 2 steel Pole Pieces — 2 cast Alnico Magnets. All are brazed to the shell at one time — the Hub with a ring of 3/64" EASY-FLO wire — the other parts, with 6 cut pieces of 3/32" EASY-FLO wire from 5/8" to 3/4" long.

◀ *Left* — Parts are assembled in jigs which locate and hold them accurately. Then the ring and pieces of EASY-FLO wire are simply placed in the positions shown by the arrows.

Close-up at right shows jig in ▶ position at gas-air burner station. Heating time per magneto, about 2¼ minutes. *Production* per 8-hour-4-man shift averages 220. Magnetos all pass a stiff air-hammer test.





Want the full story?

BULLETIN 20 tells you how to design joints and plan production to get full benefit of the great speed, strength and economy of EASY-FLO brazing. Write for a copy today.

A FIELD ENGINEER is ready to sit in and help apply EASY-FLO brazing to your metal assemblies--any time you say--without obligation. His thorough brazing know-how can help you get the right answers in quick time. Ask our nearest office to send him.

85th Anniversary

HANDY & HARMAN FOUNDED 1867 QUALITY · SERVICE

HANDY & HARMAN

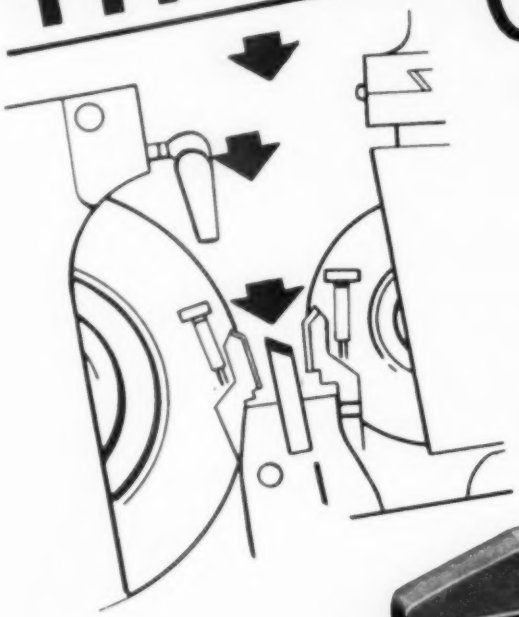
General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES and PLANTS
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CAL.
TORONTO, CANADA

TALIDE TIPPED Centerless Blades

OUTLAST ALL OTHERS!



● Production men report that Talide Tipped Centerless Blades outlast and out perform all other types of blades—on many jobs by as much as 50 times. Over the past 10-year period more Talide Tipped Blades have been used in industry than any other hard-faced blade.

Another distinct advantage which appeals to most production men is that the strip is made in one piece—not in sections butted together. There is no line or seam to scratch or mar expensive ground and polished parts.

In addition to standard blades, you can buy form or step Talide Blades for use in grinding parts having multiple diameters, steps, tapers, contours or other special shapes. Send parts or prints for estimate.

You can obtain standard Talide Centerless Blades immediately from our warehouses in Newark, Youngstown, Detroit or Chicago.

SEND FOR CATALOG 50-G

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN, OHIO.

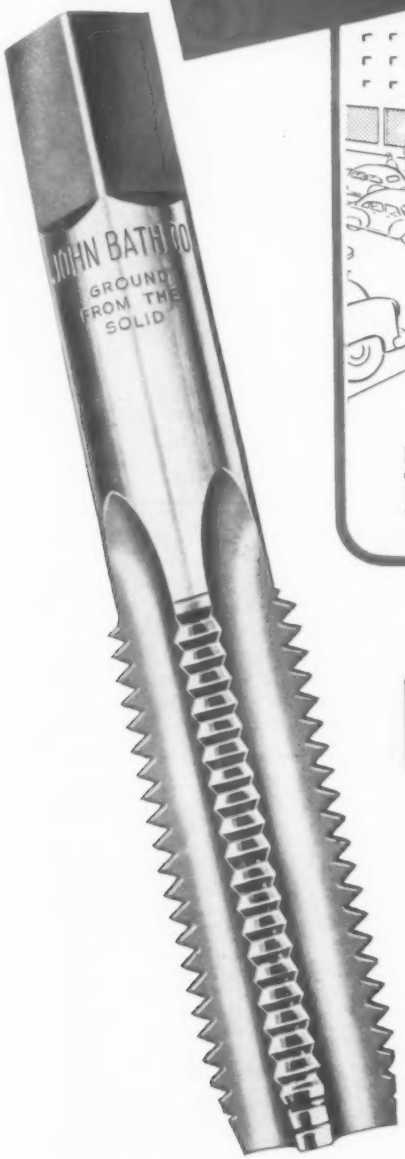
METAL CARBIDES CORPORATION

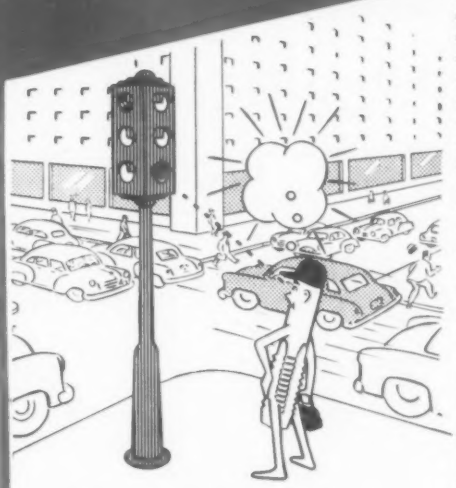
YOUNGSTOWN 7, OHIO

SINTERED CARBIDES • HOT PRESSED CARBIDES
CUTTING TOOLS • DRAWING DIES • WEAR RESISTANT PARTS

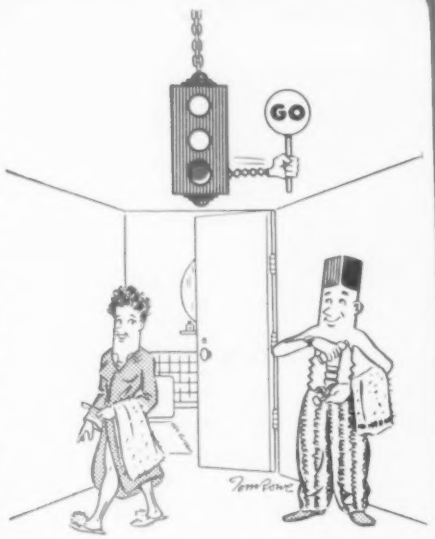
OVER 25 YEARS EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

TAP-ODDITIES





Pete says — "a traffic signal
Gives everyone a break.
Each morning when I "gotta-go" —
What a difference it would make!"



Now, bathroom rush-hour traffic,
On schedule must behave.
Pete's daughter gets 3 minutes
And Pete . . . a chance to shave!

Stay out of production "tie-ups" . . . keep your schedules "on the go" with BATH ground from the solid TAPS!

Of this you can be SURE . . . Bath Ground Thread Taps are made to give longer tap life — are accurately ground for high speed thread cutting efficiency and uniform performance.

Modern equipment is used for heat treating . . . for flute milling and grinding . . . for all steps of manufacture — to final 100% inspection. This constant check assures maintenance of BATH quality-control standards in factory procedure.

Perhaps BATH engineers can help give you the "green light" on some particular threading problem that is holding up your production speed and scheduled deliveries. The benefit of years of experience and research is yours for the asking.

INSIST ON BATH TAPS
— PROFIT BY THEIR
PLUS — PERFORMANCE

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
28 Grafton St., Worcester, Mass.

Sure Spec Drill Rod

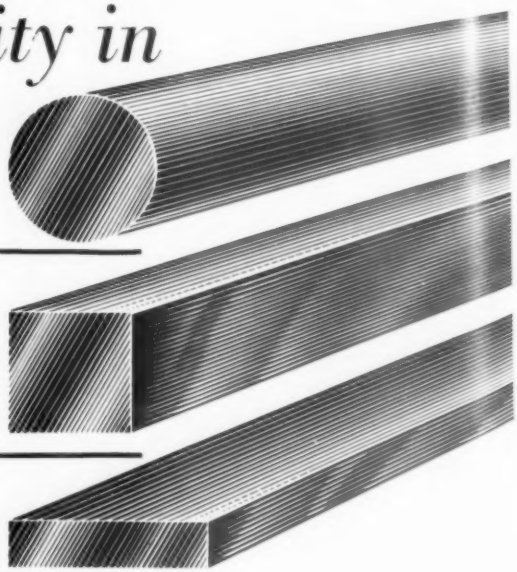
Finest Quality in

Sure Spec Drill Rod is high grade tool steel . . . comes in manufacturer's standard sizes at low prices!

ROUNDS
from .013 to 2"

SQUARES
from 1/16" to 1"

FLATS
from 1/16" x 1/8" to 1/2" x 1"



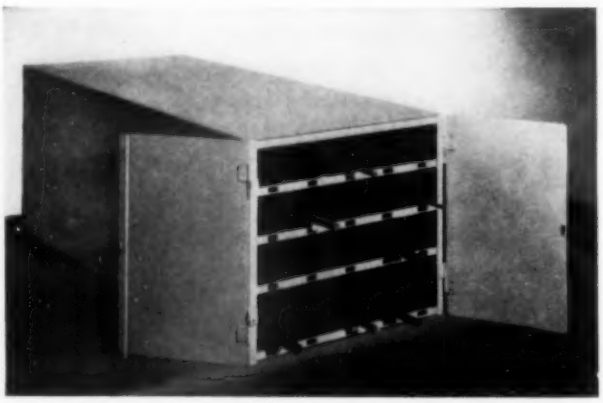
See! *this easy purchase plan . . .*

One of these safe, sturdy steel compartments, designed to protect your drill rod, is yours on this easy plan:

1. **You may get the cabinet or the floor rack free with an initial order of $150 of Sure Spec drill rod.**
2. **Or you may get a $24.95 credit for the cabinet or a $15 credit for the floor rack if your initial purchase of $150 worth of Sure Spec Drill rod is within a 90-day period.**

Send your order for plan 1 or 2 today

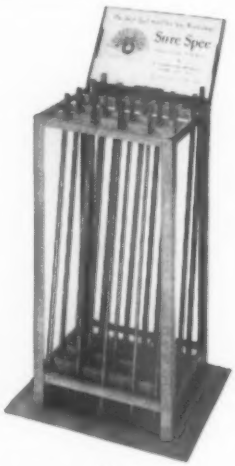
WRITE TODAY to our nearest office shown below for a comprehensive data book detailing all the facts about Sure Spec drill rod, such as sizes, analysis, uses and treating. Also, at your request, one of our sales engineers will call to discuss your particular drill rod requirements and quote prices.



With these safe, sturdy compartments to store and protect it!

Cabinet is all steel. Painted orange and black. Stocks 3-foot lengths. Has 20 separate bins.

Floor rack is all steel with composite floor mat to protect ends. Painted orange and black. 20 separate compartments. Stocks 3 foot and longer lengths.



"for service dependable as the sun"

SOLAR STEEL CORPORATION

SURE SPEC

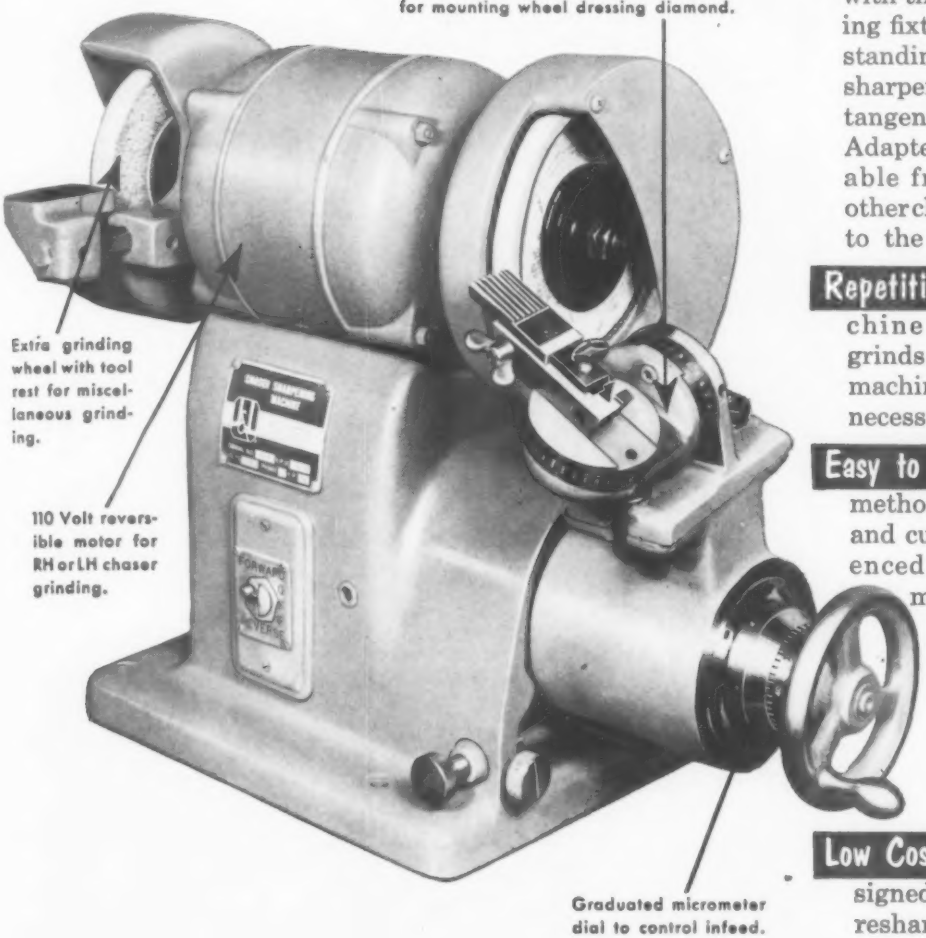
General Offices: UNION COMMERCE BUILDING, CLEVELAND, OHIO

See your local classified telephone directory for our nearest office address

SALES OFFICES: Chicago • Cincinnati • Cleveland • Detroit • Grand Rapids • Kalamazoo • La Porte, Ind. • Milwaukee • Nashville New Haven • Philadelphia • River Rouge, Mich. • Rochester, N. Y. • Toledo • Union, N. J. • Washington, D. C. • Worcester, Mass.

JONES & LAMSON
UNIVERSAL BENCH TYPE
CHASER SHARPENING MACHINE

Specifically designed to resharpen chasers, this *Low Cost*, space saving machine allows you to free heavy expensive machine tools for their intended uses, and at the same time do a better job of chaser sharpening. *It's good for miscellaneous small tool and cutter grinding too.*



Grinder set up to resharpen J & L Tangent chasers

Universal Application Equipped with the new J & L chaser grinding fixture and adapters, an outstanding job will be done on all sharpening operations, for both tangent and radial die chasers. Adapters for J & L chasers available from stock. Adapters for other chasers can easily be applied to the chaser grinding fixture.

Repetitive Accuracy This machine will duplicate desired grinds repeatedly. It is a precision machine tool equipped with all necessary stops and controls.

Easy to Operate Simple, direct methods speed up the operation and cut costs. Even an inexperienced operator can, in a few minutes, learn to resharpen chasers on this machine.

Saves Space BENCH SPACE 14 x 28 inches is ample for your complete chaser resharpening operation.

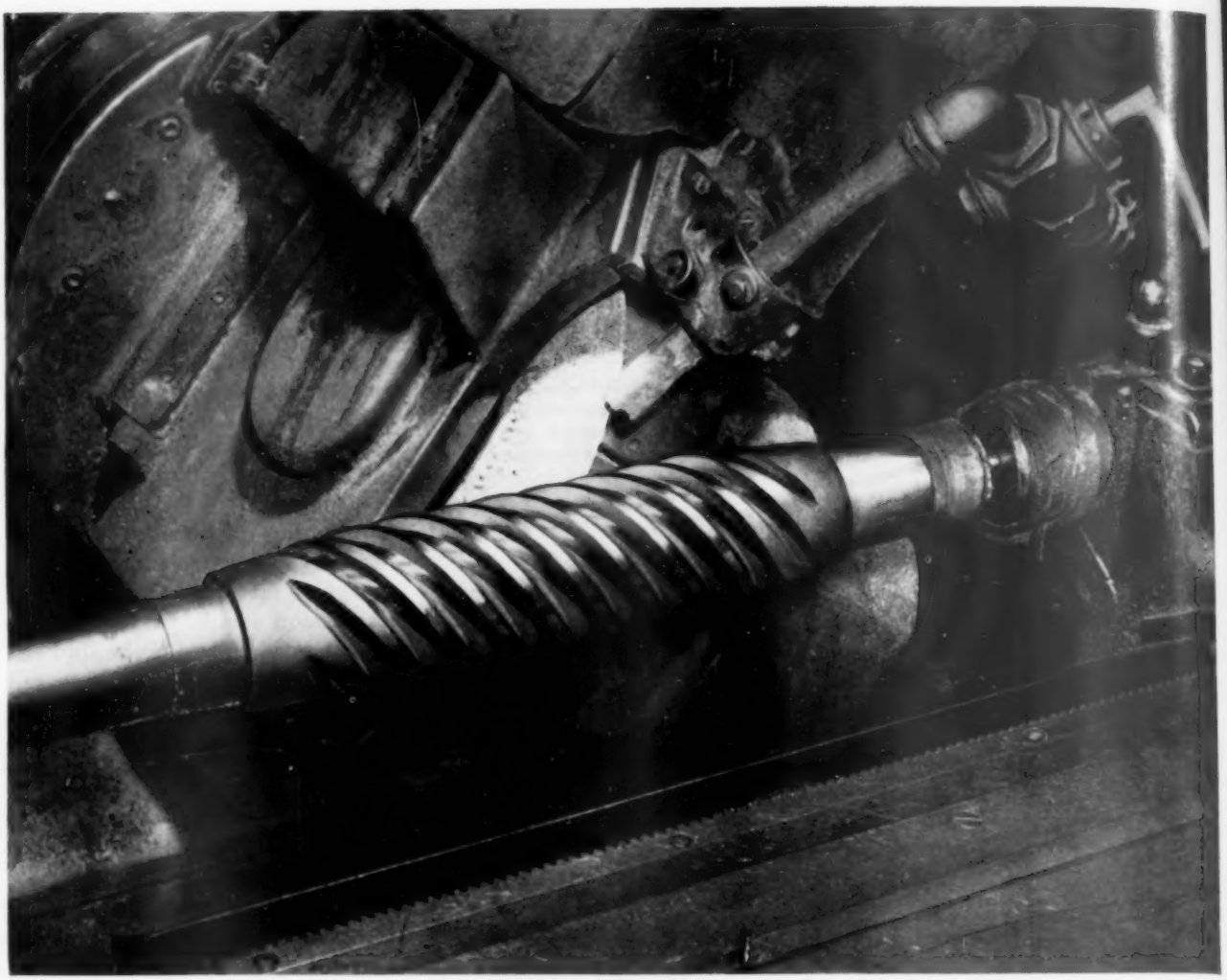
Low Cost This complete unit, designed to do your entire chaser resharpening job, sells for only a small fraction of the cost of other bulkier machines often used. Why not install one in your plant, and release your heavier, bulkier machines for their intended uses?

P.S. *Because of its size this machine can well be a time saver in shops where cutter grinding rooms are at distant points from the machines where dies are used. Write Dept. 710G for further details.*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., Springfield, Vt., U.S.A. Dept. 710 — DIE HEAD DIVISION



A producer of worm gears has found that either a Robertson 20" x ¼" x 8" RA463-JV or a Robertson 16" x ⅜" x 8" RA542-JV Wheel finishes pieces in the fewest number of cuts, at higher work speeds, and with great accuracy. They have smashed all previous records in grinding hardened triple-lead worm shafts.

YOU OFTEN GET 3 TO 5 TIMES AS MUCH PRODUCTION PER WHEEL-DRESSING WITH ROBERTSON COOL-CUT WHEELS

Production-wise manufacturers throughout the country report that Robertson Cool-Cut Grinding Wheels are increasing output as much as five times per wheel-dressing. That's because the unique open structure of these wheels permits chip clearance, enables the grains to remove the metal without loading.

Hundreds of users, on many different grinding operations, find that Robertson Wheels work better, cut faster and last longer than conventional close-grained wheels. Why not try Robertson? You'll get top results, even on the toughest grinding operations.

A producer of drop forgings making cotter-pin rivets for temporary bridge structures was taking off ⅜" stock on a plunge cut and getting only 25 rivets per wheel-dressing. This output wasn't enough. After consulting a Robertson engineer, he installed a Robertson SA54-QV Wheel. Production increased to 125 rivets per dressing.

ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY

Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments


WHEN THE
GOING IS
TOUGH...
C
CLE-FORGE
HIGH SPEED DRILLS
will give you
more holes per grind...
Telephone Your Industrial Supply Distributor
CLEVELAND
DISTRIBUTORS EVERYWHERE
are ready to serve you!
THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

Better Control of STRIP SUPPLY

● If you use over 100 tons of strip per month, in special widths, a Yoder Slitter will bring welcome relief from strip supply difficulties.

Mill-width strip is more easily obtained, from numerous sources, and at lower cost. A saving of ten to twenty dollars per ton is quite common, soon paying for the slitter investment.

With a flexible stock of mill-widths of the desired gauges, you no longer need to anticipate requirements for special widths far in advance. Your production planning becomes much easier and the need for big inventories of slit strands disappear when you can supply your own needs on a few hours' notice.

Send for literature on the economics and mechanics of slitter operation. Consultations, estimates, recommendations for the asking.

THE YODER COMPANY • 5525 Walworth Avenue, Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

Demand Has Necessitated Publishing New and Revised Second Edition

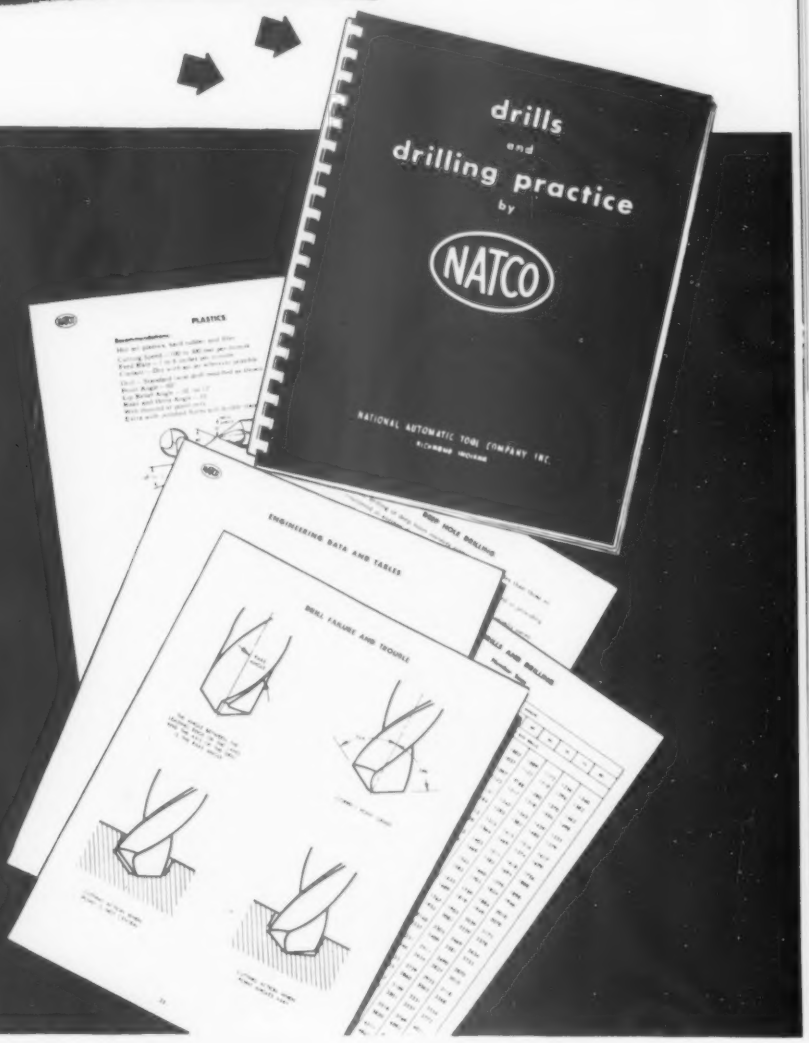
Write

FOR THIS AUTHORITATIVE NEW

62-PAGE HANDBOOK

Completely indexed for quick reference. Packed with useful information for economical drilling.

This book is the result of over fifty years of practical experience in drilling which has been accumulated from the entire NATCO engineering and operating staff.



Get your copy of

"DRILLS and DRILLING PRACTICE" *today!*

Send only one dollar with this coupon

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC.
Richmond, Indiana

BRANCH OFFICES: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

Engineering Department
NATIONAL AUTOMATIC TOOL COMPANY
Richmond, Indiana

Gentlemen: Please send me _____ copies of Drills and Drilling Practice for which I enclose _____ to cover the handling cost at one dollar a copy.

NAME _____

COMPANY _____

STREET _____

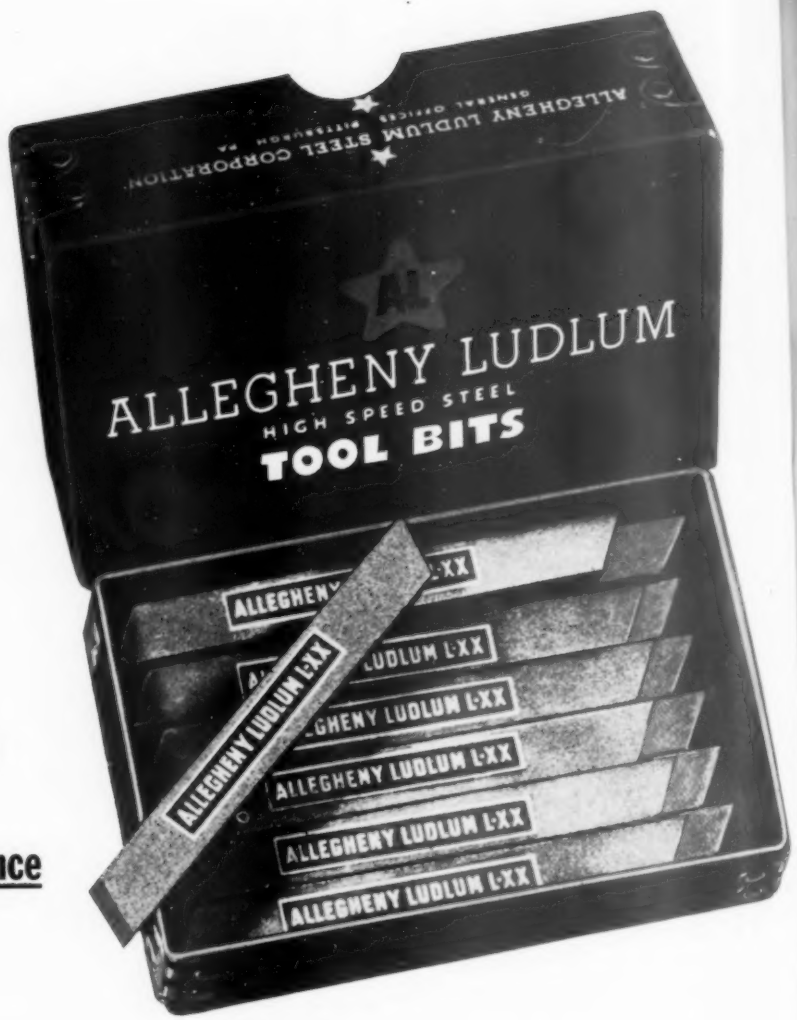
CITY _____ ZONE _____ STATE _____

HIGH SPEED STEEL

TOOL BITS . . .

Ready Made

These bits give you convenience economy, dependability



AVAILABLE in a COMPLETE RANGE of TUNGSTEN and "MOLY" Types:

SUPER PANTHER, PANTHER SPECIAL, ML, LXX, SUPER DBL and DBL-2

Pocket Price List NOW READY!

Just send a postal-card request—giving name, position, company, and address. Ask for "A-L Tool Bit Price List," pocket edition. While you're writing, also include the illustrated four-page folder, "A-L Mill Treated High Speed Steel Tool Holder Bits." Yours for the asking.

Write Today

ADDRESS DEPT. TE-33

These better tool bits, packed in the famous blue-and-gold boxes, are immediately available in standard sizes from stocks located at 28 convenient points throughout the country.

Ready Made—this means that bits are: (1) already cut to correct lengths, with clearance bevel at both ends; (2) already heat treated uniformly by mill experts; (3) furnished with either regular finish or ground finish; (4) inspected individually for hardness, size, and surface. "Finish-ground" bits are extremely accurate in dimension, entirely free from decarburization and scale, and ready for instant use upon grinding the cutting point to desired shape.

With six popular grades to choose from, you can cover a wide range of cutting needs by specifying these tool bits. Our informational service will be useful to you in selecting grades. Call A-L, or an A-L distributor.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

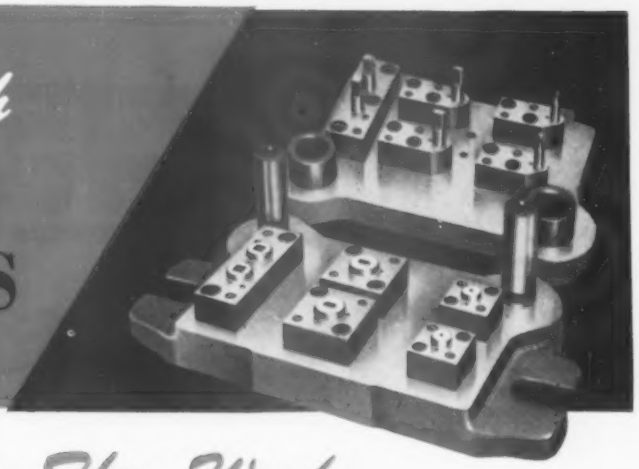
For complete **MODERN** Tooling, call

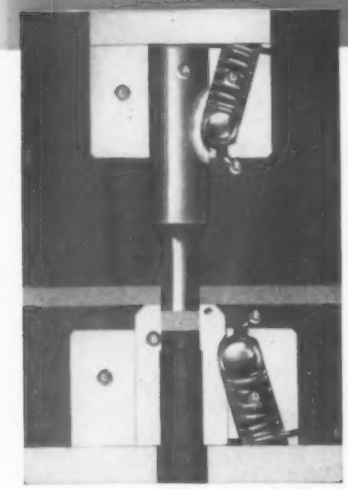
Allegheny Ludlum

W&D 3832

AL FINE TOOL STEELS SINCE 1854

You Save Time with R-B PUNCHES and DIES





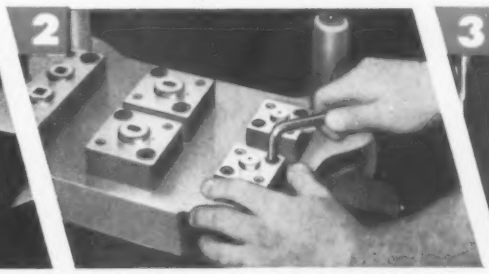
How They Work . . .

R-B punches (A) and die buttons (B) are locked in standard or special retainers (C) which are mounted on the die shoes. A spring-loaded ball lock (D) produces positive radial alignment and vertical locking; *no additional keying is necessary regardless of the size or shape of the punch.* Up to ¾" stock can be pierced. R-B punches and dies are easy to insert; push and twist and they're locked. They're easily removed, too. Retainer holes (E) provide for insertion of tanged tool which releases ball and allows instant removal.

How They Save Time

IN DIE DESIGNING

R-B standardized retainers are available in three shapes and many sizes, and where necessary, R-B special retainers can be supplied. You save "time on the board" because you are working with *standardized* equipment.



IN DIE CONSTRUCTION

R-B punch and die retainers and special retainers are quickly, easily and accurately mounted without special machining. With them, you can save much of your skilled die-makers' time.

IN DIE OPERATION

HERE'S WHERE YOU *REALLY* SAVE. R-B punches and dies cut press down time for replacement to a minimum. They're instantly removed—quickly changed—yet accurately aligned when locked.

TOOL STANDARDIZATION IS THE BASIS FOR EFFICIENT AND ECONOMICAL PRODUCTION. WITH R-B YOU GET THE ACCEPTED STANDARD OF THE SHEET METAL INDUSTRY—IN STANDARD DESIGN FEATURES THAT SAVE IN ENGINEERING, DIE CONSTRUCTION AND OPERATION.

ALLIED PRODUCTS CORPORATION
RICHARD BROTHERS DIVISION
DEPT. 63 • 12667 BURT ROAD • DETROIT 23, MICHIGAN

Please send me your 52-page free catalog.

NAME_____ TITLE_____

COMPANY_____

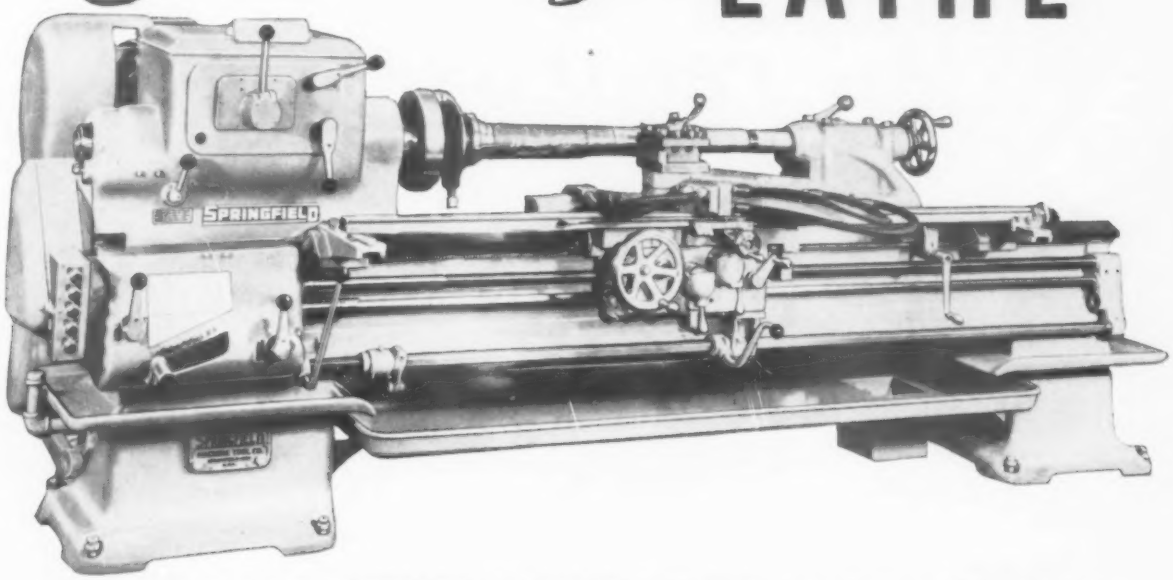
ADDRESS_____

CITY_____ ZONE____ STATE_____

Also Produced in
ALLIED'S FOUR PLANTS
HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS • SHEET METAL DIES • ALLITE DIES CAST OF ZINC ALLOY • JIGS • FIXTURES

SPRINGFIELD

Contouring LATHE



***The* simplicity of the SPRINGFIELD Hydraulic Contouring Attachment is outstanding. Pilot or control circuits, remote control valves and other troublesome elements are eliminated. A motor driven hydraulic pump, relief valve and oil reservoir are the self-contained power unit furnishing hydraulic pressure to the servo-valve and full universal hydraulic compound rest. A supported and guided adjustable template holder conveniently holds templates at the front of the lathe in full view of the operator. There are no complicated mechanisms or fragile units.**

SPRINGFIELD Hydraulic Contouring lends itself perfectly to lower production costs per unit on large or small runs.

Opposed hydraulic pressures in the hydraulic cylinder hold the slide solidly for heavy duty cutting.

Full universal hydraulic compound swivels to the best angle for contouring each individual job.

Standard SPRINGFIELD Lathes with swings from 14" to 32" are used in conjunction with the hydraulic contouring attachment thus giving complete standardization of components.

Quick changeover from standard SPRINGFIELD Engine Lathe operation to contouring is made easily.

Positive, smooth, continuous, backlash-free hydraulic movement gives superior finish on turning, boring or facing.

Close coupling of stylus, servo-valve and cylinder eliminate long hydraulic lines, sluggish action and resulting inaccuracies. The SPRINGFIELD Hydraulic Contouring attachment does not reduce the normal swing capacity of the lathe.

Write for Bulletin No. 184

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

EXCLUSIVE REPRESENTATIVES IN ALL PRINCIPAL CITIES


Invest in better methods for guaranteed returns
Automatic Bar and Chucking Machines • Precision Boring Machines
Lucas Horizontal Boring, Drilling and Milling Machines
New Britain +GF+ Copying Lathes
THE NEW BRITAIN MACHINE COMPANY
NB
NEW BRITAIN
Automatics
THE NEW BRITAIN GRIDLEY MACHINE DIVISION
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT

FREE Cylinder Catalog and Templates offered by Ortman-Miller Co.

Book outlines several special features of O-M cylinders.

FREE

A new, 28 page catalog has just been released by the Ortman-Miller Machine Co. which gives complete engineering specifications, data on O-M's special internal locking system and special full listing of O-M parts. Prepared for designers and users of cylinders for any application, it covers standard, oversize and 2-1 piston rods, giving full information on all sizes from 1½" to 8" bores.

SPECIAL FEATURES

Included are detailed explanations of the many features which have made ORTMAN-MILLER cylinders standard in thousands of plants throughout the country. Detailed drawings and copy explain the special shear bar assembly which completely eliminates bulky end caps and tie rods, thus saving up to ⅓ in space. In addition, it shows the vast number of interchangeable mountings and applications which almost always eliminate the need for special castings or patterns. This feature alone not only saves initial costs, but cuts down on inventory and greatly speeds up delivery on every order.

Special Note:

30 DAY DELIVERY

Increased production facilities and standardization of parts continue to make possible delivery in 30 days or less on almost all orders for O-M cylinders. Write today for details.

FREE TEMPLATES

In addition to the FREE catalog, Ortman-Miller also leads the field in making available FREE TEMPLATES of all O-M cylinders. Prepared in half and quarter scale, they are extremely useful in design and application of O-M cylinders to your special requirements.

For your FREE Catalog or templates, use the coupon in the ad at the right. Or write to ORTMAN-MILLER Machine Co., 1216 150th St., Hammond, Indiana.

We don't want to return your order!

The Rivett organization is doing a tremendous job of trying to keep up with the demand that has developed during the past several years for Rivett components. We are receiving more valve and cylinder orders today by far than we thought possible 18 months ago.

Capacity has been increased, new machinery installed, production techniques improved, and a large inventory of finished parts built up, ready for assembly.

The one thing responsible for this demand, and the occasion for this message, is the reputation for quality which Rivett products have earned. We must maintain our standards of workmanship in the face of this increased business. And when you send us an order for equipment which is not catalogued as a standard item, we cannot always make delivery as quickly as we both would like. It brings tears to our eyes when we find you will not wait a very short while for the extra quality of a Rivett specially designed component.

To help expedite your Rivett order, we offer these suggestions:

1. Contact your Rivett representative. He can recommend the correct valves and cylinders and make circuit suggestions which may save you time and money. Also, he may have in his stock the exact component you need. And he can improvise your circuit until new Rivett components arrive.
2. Stick to standard components in designing your circuit. Rivett catalogs over 400 standard models, and can deliver faster from semi-assembled stock.
3. Anticipate your requirements early and place your order promptly.
4. If you do need a special design and cannot wait a short while for the extra quality of Rivett, then ask your Rivett representative to recommend the next best source who can handle your requirements. His suggestion may help to save you time and money later.

Newark & New York—Compressed Air Products, 1977 Springfield Ave., Maplewood, N. J., 257 Greenwich St., New York City 7, N. Y.
Philadelphia, Pa.—The Battersby Co., 3701 N. Broad St.
Boston, Mass.—L. W. Sheehy, 1104 Park Sq. Bldg.
Baltimore, Md.—Colliflower, Inc., Baltimore National Pike, Ellicott City, Md.
Rochester, Syracuse and Buffalo, N. Y.—Windheim Tool Company, 24 Ford St., Rochester 8, N. Y.
Pittsburgh, Pa.—F. R. Magill Co., 44 McKnight St.
Cleveland, Ohio—Garco Machy. Co., 21000 St. Clair
Detroit, Mich.—Fors Sales Co., 2832 E. Grand Blvd.
Flint, Mich.—Shively Sales Company, 719 E. 2nd Ave.
Chicago and Milwaukee—MacMillin Engineering Corp., 1737 Howard St., Chicago 26, Ill.
St. Louis, Mo.—William Scheer Co., 6376 Clayton Rd.
Dayton, Ohio—Seifreat-Elstad Machy., P.O. Box 332
Cincinnati, Ohio—Seifreat-Elstad Machy., P.O. Box 2508
Columbus, Ohio—Seifreat-Elstad Machy., P.O. Box 922
Columbus, Ga.—Bunn H. Martin, P.O. Box 350
Minneapolis, Minn.—Anderson Machine Tool Co., 2641 University Ave., St. Paul 4, Minnesota
Denver, Col.—Iver J. Esbenson Co., 1249 Calif. St.
Los Angeles, Calif.—The Paul-Munroe Co., 4867 E. Gage Ave., Bell, Calif.
San Francisco, Calif.—Ditzen Engineering and Sales, 600 16th St., Oakland 12, Calif.
Oregon and Washington—Hydraulic Power Equipment Co., 2316 N. W. Savier St., Portland, Ore.
Canada—Duncan Machinery Co., Ltd., 1922 Wyandotte St. East, Windsor, Ontario; 371 Bay St., Toronto

RIVETT LATHE & GRINDER INC. • Brighton 35, Boston, Mass.
Department TE-9

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS

Air and Hydraulic
All sizes and types

TAFT-PEIRCE *Precision Gage Blocks* are built for Lasting Accuracy

Set 82A provides all dimensions from .200" to 12.000" in steps of .0001", and from .300" to 12.000" in steps of .00005".

Set 35A provides all dimensions from .300" to 8.000" in steps of .0001".

Tungsten Carbide Wear Blocks add more years to the life of your gage block sets. Manufactured in two sizes . . . 0.050" and 0.100" . . . they can be wrung to any gage block combination.

To maintain the ultimate in accuracy — you can rely on these Taft-Peirce Precision Gage Blocks. They're lapped to the highest degree of flatness — carefully hardened for wear resistance — and treated to eliminate seasonal changes. Easily handled. Instantly identified by large size-markings on the sides. You'll find no finer gage blocks to keep your quality control standards dependably right.

Available in single blocks or sets. Write today for more information.

THE TAFT-PEIRCE MANUFACTURING CO., WOONSOCKET, RHODE ISLAND

Branch offices in all principal cities

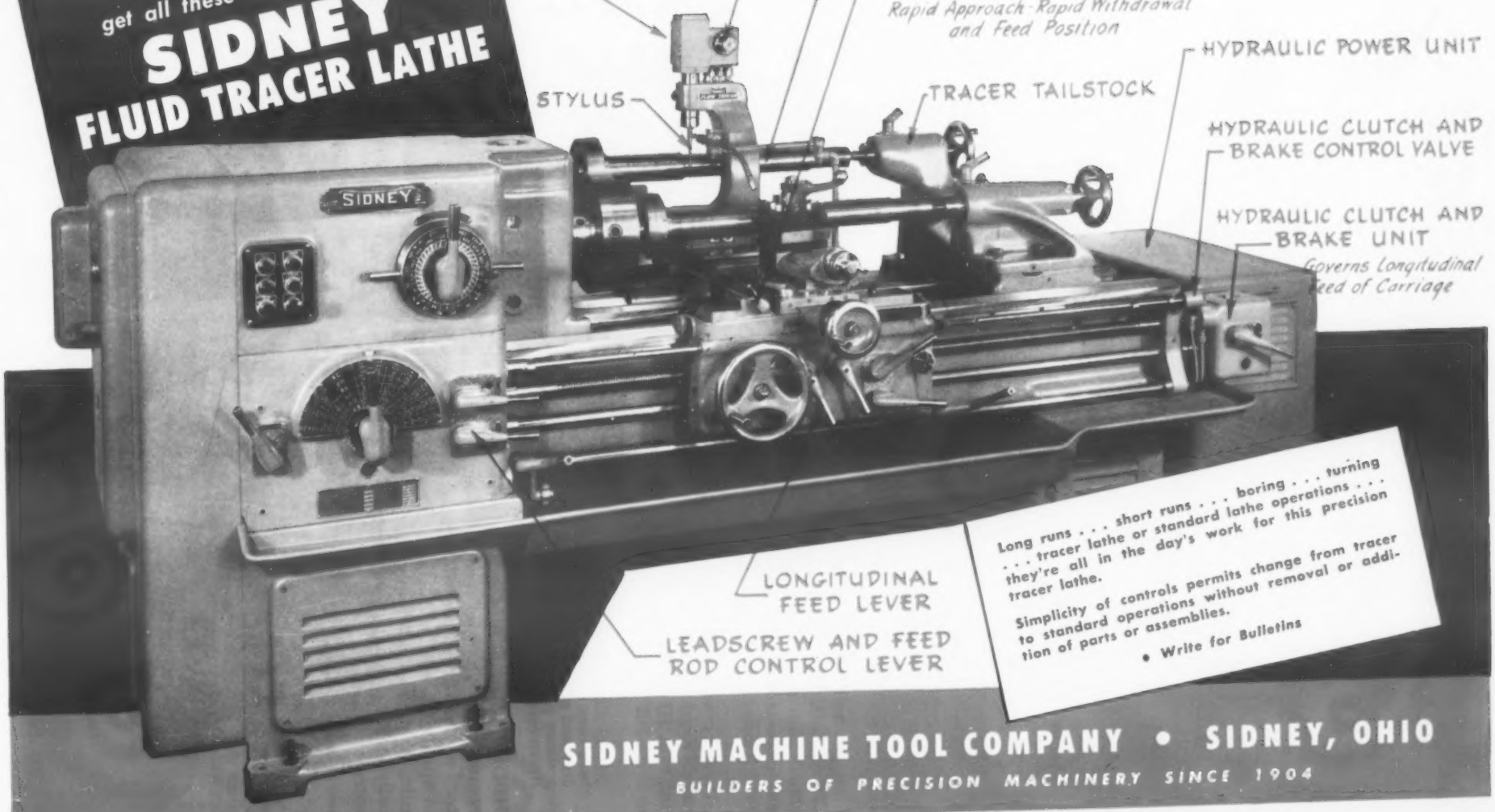
T-P means TOP PRECISION

WANT ? INCREASED PRODUCTION
IMPROVED QUALITY
LOWER PRODUCTION COSTS

get all these and more in the

SIDNEY FLUID TRACER LATHE

A PRECISION DUPLICATING ATTACHMENT



Long runs . . . short runs . . . boring . . . turning . . . tracer lathe or standard lathe operations . . . they're all in the day's work for this precision tracer lathe.

Simplicity of controls permits change from tracer to standard operations without removal or addition of parts or assemblies.

• Write for Bulletins

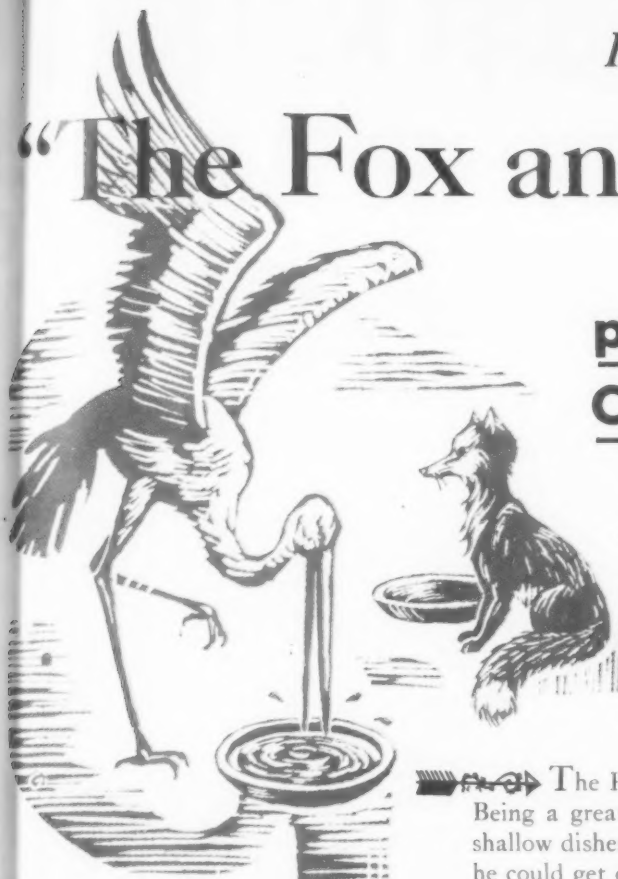
SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

BUILDERS OF PRECISION MACHINERY SINCE 1904

How

"The Fox and The Stork"

points a moral to Cutting Fluid users



. . . with apologies to Aesop

The Fox was playing host to the Stork at dinner. Being a great prankster, he served nothing but soup in shallow dishes. The poor Stork got nothing to eat because he could get only the tip of his long bill into the soup.

The Stork reciprocated by having the Fox to a dinner at which he served delicious rice in long thin-necked jars. This time the Fox went without food because he couldn't even get his nose into the jar!

THE MORAL:

Like the Fox and the Stork in Aesop's fable, each cutting fluid has its own capabilities. When put on an application for which it is not suited the cutting fluid fails to give you the production, tool life or finish possible.

Stuart offers you a vast background of experience in the *selection and application* of cutting fluids, both water-mixed and straight oil types and has the cutting fluids to best meet your requirements. Ask to have a Stuart Representative demonstrate how proper selection and application of cutting fluids saves time, money and materials. Be sure to ask him for the booklet "More Than a Coolant Is Needed."

More Than a "Coolant" is Needed

D. A. Stuart Oil co.

EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727-49 S. Troy St., Chicago 23, Ill.

Free! Dilut-o-graph

Circular slide rule makes dilution of cutting fluids quick, easy! For tanks of 1 to 100 gallons. Fill in coupon, clip to your company letterhead and mail to:

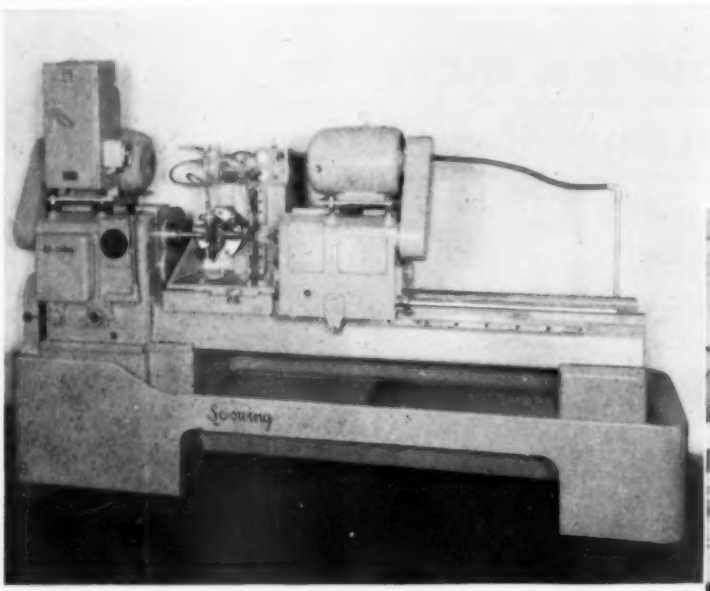
D. A. STUART OIL CO.
2727-49 S. Troy St., Chicago 23, Ill.

Name .....

Title .....

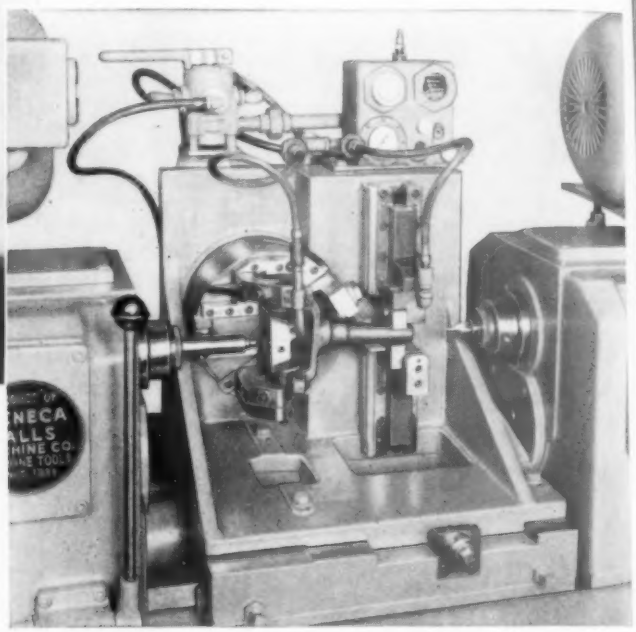
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK



◀ General view of Model CS Centering Machine equipped for centering front wheel pivots.

▼ Close up view of special work holding fixture.



MODEL "CS" CENTERING MACHINE CENTERS FRONT WHEEL PIVOTS ACCURATELY, ON HIGH PRODUCTION BASIS

Problem: To center both ends of front wheel pivots without distorting the stem end.

Solution: The standard Model CS Centering Machine equipped with a special work holding fixture was selected for this job. The work comes to the machine as a rough forging without any previous machining. The work holding fixture consists of a special round chuck mounted on a spindle yet free to revolve a few degrees on each side of the center line. This prevents any bending of the part when the 2-jaw vise closes on its small end. The chuck and vise jaws are operated with separate air cylinders installed on the rear of the fixture and controlled by a 4-way air valve.

The operator places the rough forging in a loading cradle, against a spring-loaded V-block, which positions it in relation to the opening between the lugs at the large end. The air valve is then operated and the large threaded stud, fitted to the inclined air-operated cross slide, forces the part back into the stationary V-blocks. A second movement of the air valve closes the 2-jaw air-operated vise. Starting handle is then positioned forward and the machine goes through its cycle automatically. Both ends are centered simultaneously.

Seneca Falls engineers welcome inquiries involving difficult machining problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

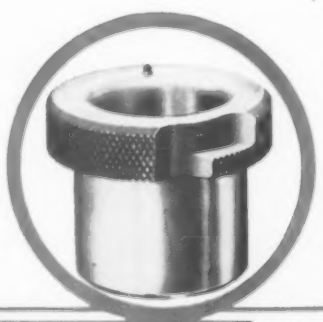
Want Something Special?

If you need *special sizes,* or have unusual drill bushing needs, give us the problem. Our competent staff engineers will promptly recommend the best size and type drill bushing for the job.

The entire effort of American Drill Bushing Company is directed toward producing *precision* drill jig bushings to meet your requirements.

Our exclusive distributors throughout the nation maintain complete stocks of standard types and sizes, for immediate delivery.

Call American if you want SOMETHING SPECIAL!



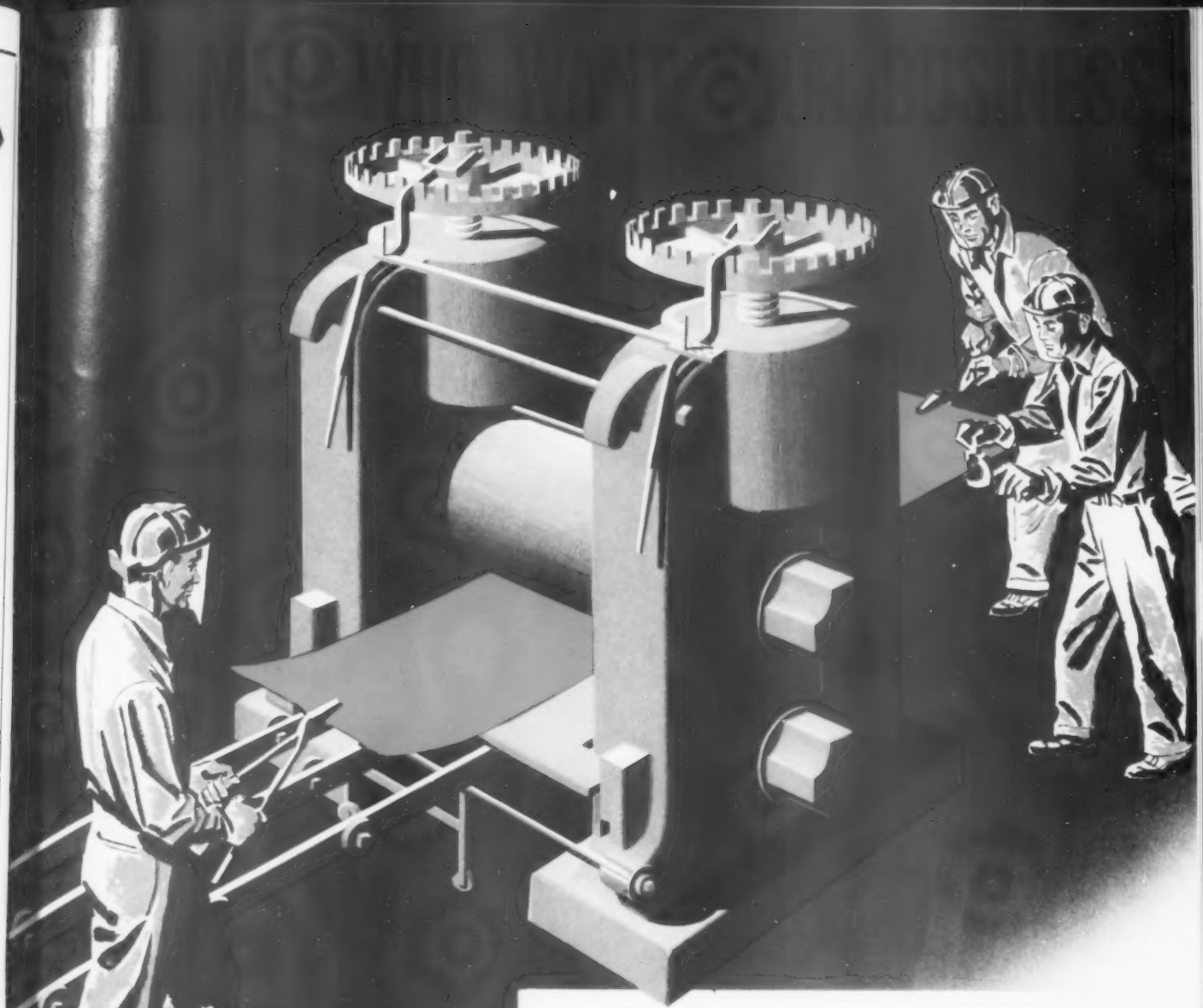
LOOK FOR THE TRADE MARK

SPECIALIZING ONLY IN DRILL JIG BUSHINGS

Send for Catalog and name of nearest Distributor

American  **DRILL BUSHING CO.**

5107 PACIFIC BOULEVARD, LOS ANGELES 58, CALIFORNIA



The Jessop 20-inch alloy-steel hand-mill pictured above is a very dependable piece of mechanism, and the men who attend it are highly skilled and proud of their craft. On that mill, Jessop men roll what they consider to be the best steel of its kind obtainable anywhere. It is used for a variety of purposes, from hack-saw blades to wood-working tools and metal-slitting saws to general industrial knives, and is known in the trade as high-speed sheet.

We are willing to admit that our 20-inch mill is not working as many shifts as those enthusiastic Jessop mill men would like it to work. Here's what they would like you to do. If you have any idea your company might use this type of steel, contact Jessop. You will gain, because every member of the Jessop team, including the men on this mill, will strive to bring you better steel on a better delivery schedule than you have ever known before. Please write or call.

JESSOP

STEEL COMPANY · WASHINGTON, PENNSYLVANIA

Medal of Honor

Major General William F. Dean, of Berkeley, California—Medal of Honor. In the hard early days of the Korean War, when it was Red armor against American rifles, General Dean chose to fight in the most seriously threatened parts of the line with his men. At Taejon, just before his position was overrun, he was last seen hurling hand grenades defiantly at tanks.

General William Dean knew in his heart that it's every man's duty to defend America. You know it, too. The General's job was in Korea and he did it superbly well. Your defense job is here at home. And one of the best ways to do that job is to start right now buying your full share of United States Defense* Bonds. For remember, your Defense Bonds help keep America *strong*, just as soldiers like General Dean keep America safe. And only through America's strength can your nation . . . and your family . . . and you . . . have a life of security.

Defense is your job, too. For the sake of all our servicemen, for your own sake, help make this land so powerful that no American again may have to die in war. Buy United States Defense* Bonds now—for *peace!*

Remember that when you're buying bonds for national defense, you're also building a personal reserve of cash savings. Remember, too, that if you don't save *regularly*, you generally don't save at all. Money you take home usually is money spent. So sign up today in the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you bank. For your country's security, and your own, buy U. S. Defense Bonds now!

**U.S. Savings Bonds are Defense Bonds - Buy them regularly!*

The U. S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America as a public service.

Neither can you get peak performance in CENTERLESS GRINDING with improper wheel selection.

Conscientious, skilled craftsmanship . . . Modern Manufacturing Equipment . . . Research Facilities . . . Personnel with Extensive Engineering Background . . . Exclusive Manufacturing Features . . . these factors all contribute to BAY STATE'S continued success in recommending proper grits, grades and bonds that completely solve centerless grinding wheel problems.

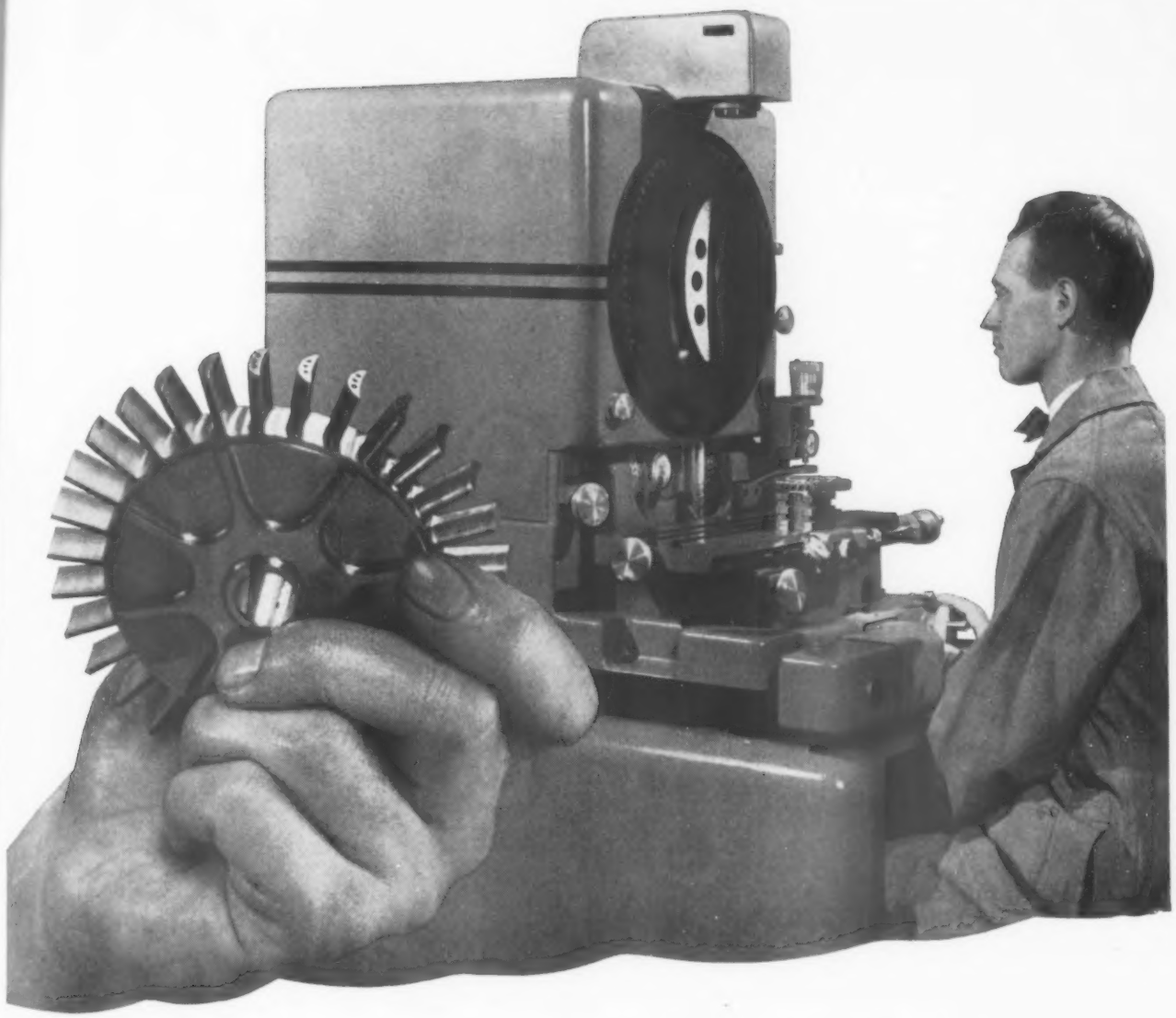
BAY STATE

A wide range of sizes and specifications of vitrified centerless grinding wheels and rubber regulating wheels available for immediate shipment.

BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Massachusetts, U. S. A.

Branch Offices and Warehouses:
Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All Principal Cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

Why not ask for a BAY STATE abrasive engineer to prove a new peak of performance on your job today!



For Rapid, Accurate Inspection of Difficult Shapes

If you've been thinking of inspection by optical comparison only in terms of silhouetting simple parts, you may be overlooking a chance to lower your inspection costs, speed the work.

For example, with the Kodak Contour Projector, there's a trick made possible by the unique Surface Illuminator. To inspect the above impeller that goes into a jet engine component, Eclipse-Pioneer Division of Bendix Aviation Corporation projects the end of a blade by light directed straight on it *out of the same lens that picks up the image.* Conventional shadow projection just wouldn't do it.

In measuring this part, the two micrometers used operate independently of the elevating and cross-travel screws to eliminate strain and wear. They are provided with dial pressure indicators—there's no "micrometer feel" required. The operator works unhampered by hoods or curtains, needs little training to get the work out in a hurry.

If your need is for toolroom measurement, the Kodak Contour Projector, Model 2A, is your choice. If your need is for fast production inspection, the economical, stripped-down Model 3 will meet your requirements. There is a field engineer in your area who will be glad to discuss your requirements with you. No obligation, of course. To get started, write to Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Optical Gaging

A new sound movie shows how to simplify complex inspection problems. We'll tell you how to get it for a showing.

Kodak
TRADE-MARK

Designed
for those who needed a
LIGHT-HEAVYWEIGHT
Machine

—that's the WALKER-TURNER line

For jobs where neither the capacity nor expense of a heavy industrial machine is warranted, and where a "hobby machine" would be wholly inadequate, Walker-Turner has engineered a special class of light-heavyweight power tools.

Professional in design and operation, yet light for production machines, the Walker-Turner "in-between" line gives industry the capacity needed for short-run production work, without the necessity of heavy investment. For complete information, write your name and address in the margin below.

WALKER-TURNER
• DIVISION •
KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS
BELT and DISC SURFACERS • METAL-CUTTING BAND SAWS
LATHES • SPINDLE SHAPERS • JOINTERS

SOLD ONLY THROUGH
***TRAINED* INDUSTRIAL DISTRIBUTORS**

NEWEST LIGHT-HEAVYWEIGHT
15″ WALKER-TURNER DRILL PRESS
WITH 6″ SPINDLE TRAVEL

Designed for fast, accurate drilling at new low levels of investment and production costs. Features calibrated depth indicator. Capacity: Bench Models — 12″ chuck to table, 17½″ chuck to base. 10″ x 12½″ table. Six spline spindle mounted on 2 ball bearings. 4 speeds — 600, 1250, 2440 and 5000 r.p.m. with 1750 r.p.m. motor. Available in bench, floor and multi-spindle models.

. . . . *Use this space* . . . . .

to write for full details and specifications
Walker-Turner Division, Kearney & Trecker Corp.
Dept. T9, Plainfield, N. J.
(Please write your name and address in margin of page)

QUALITY CARBIDE TOOLS

Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

MODERN PRECISION TOOLS

MODERN COLLAPSIBLE TAPS

Modern Self-Opening Die Heads are available in both stationary and rotary types. The stationary type is made in a range of sizes with capacity for cutting straight threads from 1/8" to 7", and 1/8" to 6" for pipe threads.

MODERN SELF-OPENING DIE HEADS

Of unusually simple design with a minimum number of parts and no complicated mechanisms, this new Modern Collapsible Tap Style A-A helps meet industry's demand for faster, lower cost production. It is made in a wide range of sizes with adequate capacities for cutting straight threads and straight and taper pipe threads. All parts are of properly hardened steel, ground and precision fitted.

Modern-Magic Quick Change Chuck and Collet Equipment virtually eliminates costly idle time usually present in revolving spindle operations. Tools are changed without stopping or even slowing the spindles. Modern-Magic Chucks are made in 6 sizes and two types: friction drive and positive drive. Modern-Magic Collets are available in a broad range of both standard and special types.

Modern Self-Opening Stud Setters are positive and entirely automatic in action, and can be operated in any position with either air or electrically driven portable tools. Also equally effective in drill presses where it is possible to drill and tap the holes and set the studs in successive operations. Made in two sizes 1/2" and 7/8" capacity.

Modern Medium Duty Face Milling Cutters are of blade backed design, and are made in axial and radial types. Standard Modern axial type cutters are available in diameters from 4" to 24". Standard radial type cutters from 8" to 24" diameters. All blades, wedges and screws are interchangeable in all Modern Cutters regardless of diameters.

MODERN-MAGIC CHUCKS AND COLLET EQUIPMENT

Detailed information covering any Modern Precision Tool in which you are interested will be furnished promptly upon request. Let us show you how Modern Precision Tools can help to speed up your production and reduce your costs.

Modern Precision Tools Include . . . . .

- STATIONARY SELF-OPENING DIE HEADS
- ROTARY SELF-OPENING DIE HEADS
- STATIONARY COLLAPSIBLE TAPS
- ROTARY COLLAPSIBLE TAPS
- MODERN-MAGIC CHUCKS AND COLLETS
- SELF-OPENING STUD SETTERS
- INSERTED BLADE FACE MILLING CUTTERS
- SOLID ADJUSTABLE DIE HEADS
- ADJUSTABLE HOLLOW MILLING TOOLS
- UNIVERSAL CHASER GRINDING FIXTURES

MODERN SELF-OPENING STUD SETTERS

MODERN FACE MILLING CUTTERS

Modern Precision Tools are produced by the originators of the Modern-Magic Quick Change Chuck and Collet Equipment.

MODERN TOOL WORKS

DIVISION

CONSOLIDATED MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

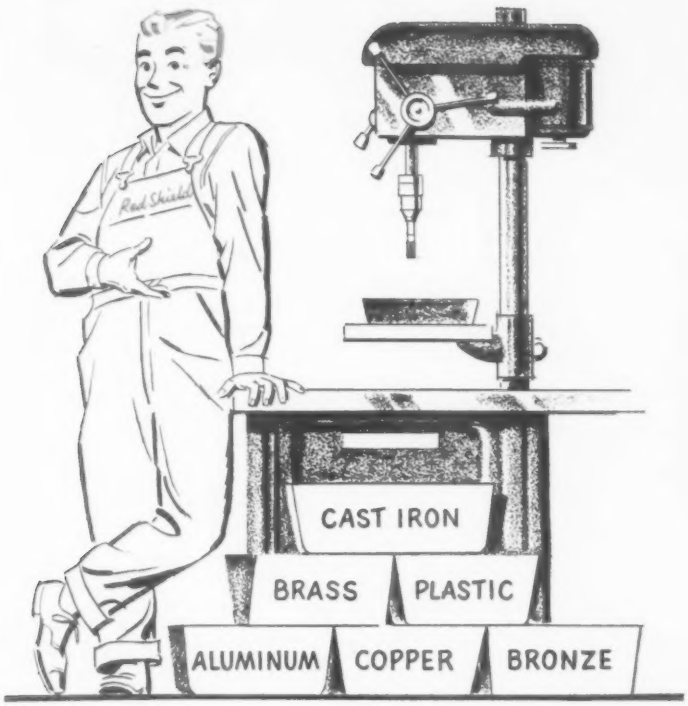
Jigs and Fixtures that are easier to handle increase production. Alcoa Cast Aluminum Tool and Jig Plate is lighter...easier to machine. And is available for immediate delivery*

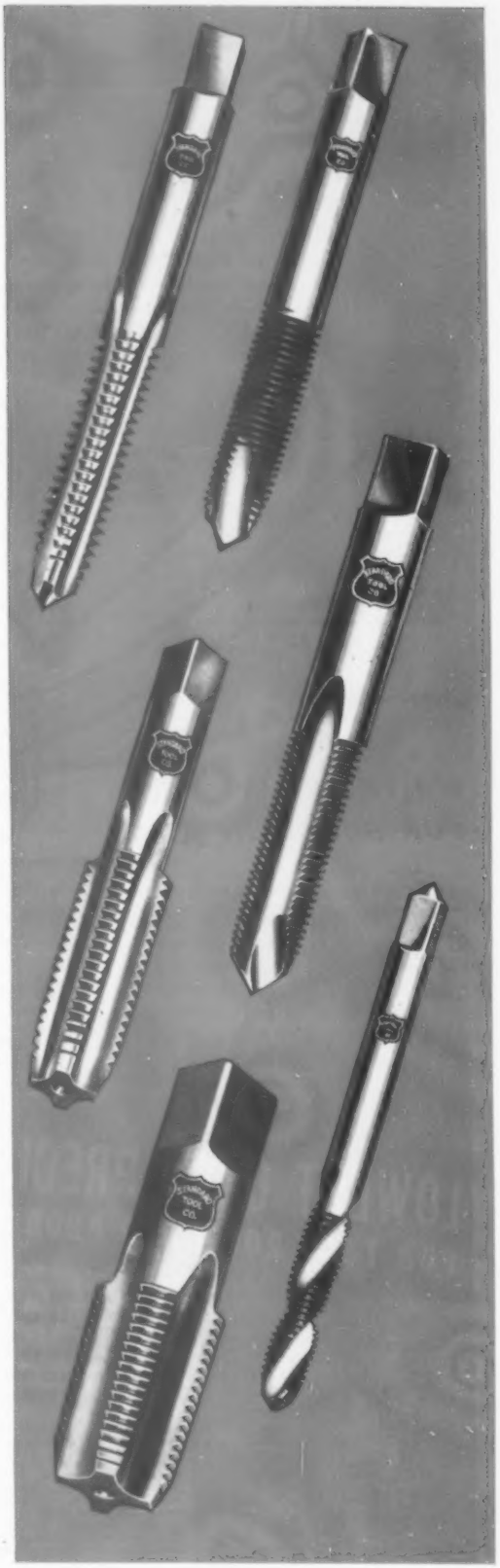
- ▶ Moderately Priced
- ▶ Easy to Machine
- ▶ Normalized...Strain Relieved
- ▶ Tolerances on Plates of thicknesses from 1/2" to 4", held within ±.010"
- ▶ Widths and lengths: cut to any desired dimensions up to 48" x 96"

* *For more information on Alcoa Tool and Jig Plate, contact your local Alcoa sales office . . . or Aluminum Company of America, 1952-J Gulf Bldg., Pittsburgh, Pa.*

ALCOA

TOOL AND JIG PLATE





Special metals to tap? Red Shield makes it easy

TAPPING operations on materials such as aluminum, plastic, cast iron and non-ferrous metals are often unduly costly or slow.

To speed up and reduce the cost of such operations, specify and use Standard Red Shield Taps that are designed for use on these materials. Uninterrupted production and superior quality work results.

Standard service engineers are always glad to offer helpful suggestions on tapping problems. No cost or obligation. Reliable Mill Supply Distributors coast to coast provide efficient service on all Standard Red Shield metal cutting tools. It pays to Standardize.

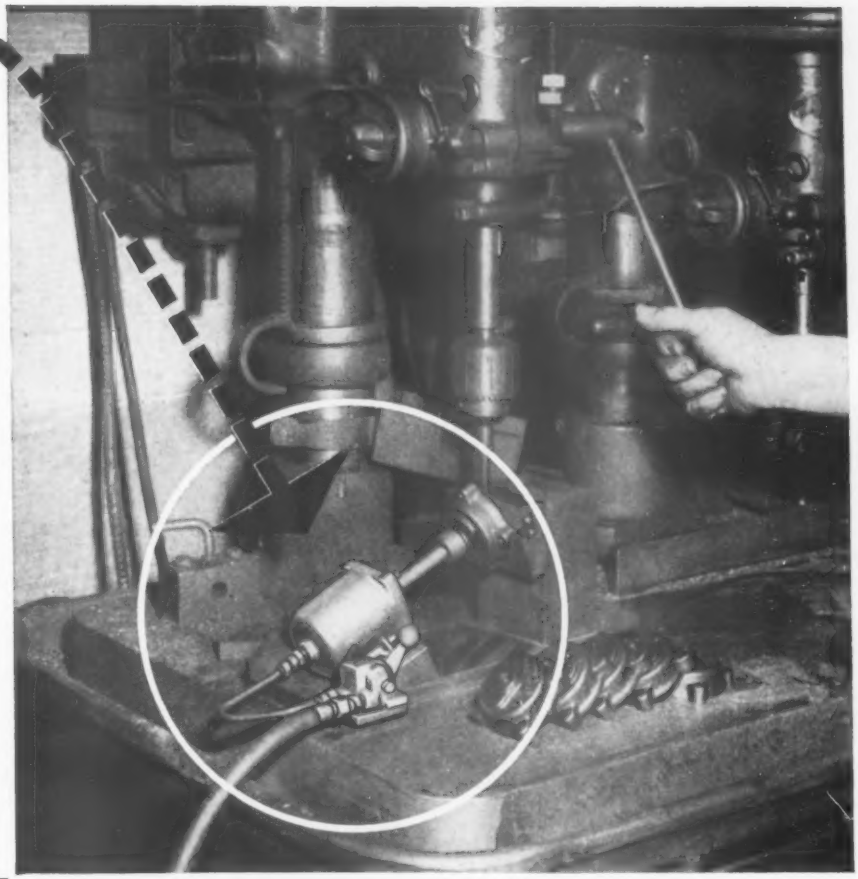
STANDARD TOOL CO.

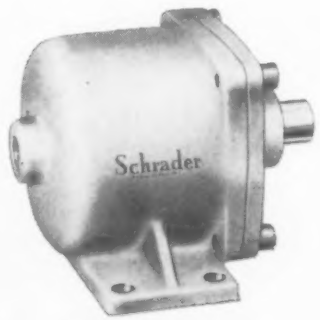
3950 CHESTER AVENUE
CLEVELAND 14, OHIO

New York • Detroit • Chicago • Dallas • San Francisco

STANDARDIZE AND SAVE WITH STANDARD RED SHIELD METAL CUTTING TOOLS.
THERE IS A STANDARD DISTRIBUTOR NEAR YOU AND READY TO SERVE YOU.

Simplify any work-holding problem





ClampAir Cylinder

Watch a worker making ready for a simple drilling operation. He places the work in a fixture and hand-clamps it. With everything all set to go, you'll find he takes as much as ten seconds just to grip the work tightly in the clamp.

Multiply that by thousands of machining operations in a normal high production shop. You'll find a substantial portion of work time is used up before actual production is begun.

You can eliminate nearly all of this lost time with the new Schrader ClampAir. What's more, since the ClampAir takes no more effort than opening a valve, high-priced workers are not tired by useless labor.

The ClampAir is actually a bantam air cylinder, with plenty of power to hold work firmly in place—with the same holding force every time. That means the end of rejects caused by inconsistent holding forces.

The number of places where ClampAir can serve you well is on drill presses, milling machines, gluing operations, and others too numerous to mention. In all of these, production rates can be upped to higher percentage brackets with ClampAir. And, since ClampAir is basically a push type cylinder, it can be used in many other spots where you need a short, hard stroke.

It's easy to find out how ClampAir can shorten production time, increase worker efficiency. Write, outlining the applications in which you are interested—or fill out the coupon below. We will be glad to help you determine your needs.

Schrader
REG. U. S. PAT. OFF.

products control the air

Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

Mail This Coupon Today

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
468 Vanderbilt Avenue, Brooklyn 17, N. Y., Dept. M-S

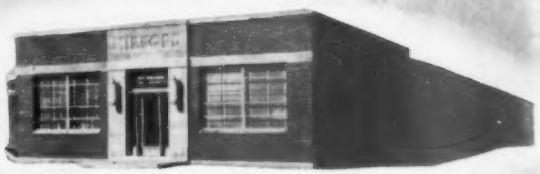
I am interested in more information on.....

Name _____ Title _____

Company _____

Address _____

NEW ENGLAND DIVISION MILFORD, CONN.



ILLINOIS DIVISION AURORA, ILL.

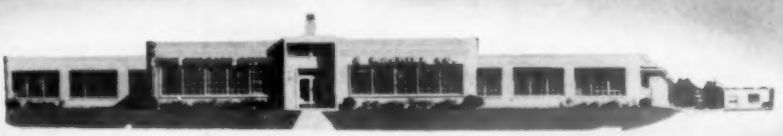
NOW 4 MODERN PLANTS

on industry's doorstep to expedite service of your needs for

QUALITY

tubular and split rivets, rivet-setting machines and special cold-headed fasteners

OHIO DIVISION ELYRIA, OHIO



PENN. DIVISION HATBORO, PA.

MILFORD
the name to **RIVET** in your memory
for faster, firmer, finer fasteners

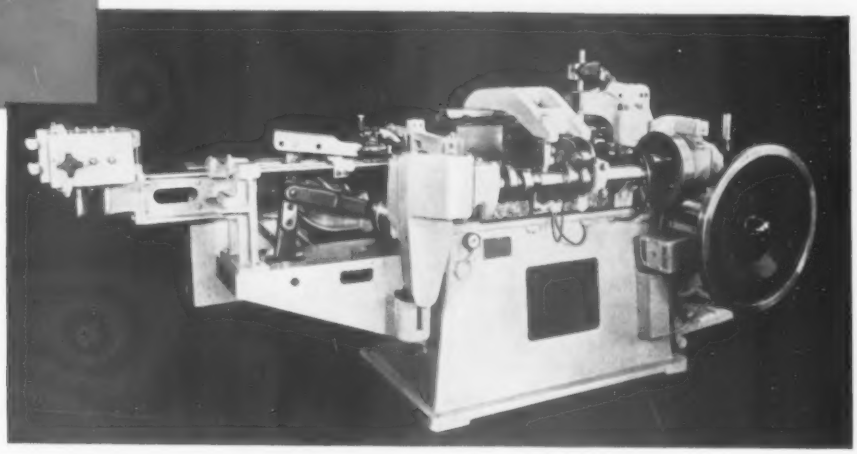
Est. 1919

the **MILFORD RIVET & MACHINE CO.**

867 BRIDGEPORT AVENUE, MILFORD, CONN.

★ WRITE FOR CATALOG

Eliminate Secondary Operations —— Reduce Costs - - -



Blanking*

Piercing*

Trimming*

Swaging*

Coining*

Forming*

*Produce parts requiring any or all of these operations complete at one stroke of the U. S. Multi-Slide ®

To meet competition today manufacturers must closely control costs. Secondary operations, inspections and handlings must be eliminated wherever possible.

In the production of precision formed stampings from coil stock, the U. S. Multi-Slide ® can effect substantial savings because it completes a finished part at each stroke of the machine. Many different types of parts which would ordinarily require costly secondary operations can be profitably produced. And since parts are produced complete—uniformly and to close tolerances—the number of inspections is also reduced.

The illustration above shows a typical part which is produced complete in the No. 33 Multi-Slide. This machine has a capacity for material up to 2½" wide. If your program involves the production of precision stampings, investigate its labor-saving, time-saving features. Ask for a copy of Bulletin 15 containing complete specifications.

US PRODUCTS

® Trade Mark Reg. U. S. Patent Office

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

NATIONWIDE DISTRIBUTION

CALL, WRITE OR WIRE THE BOYAR-SCHULTZ GRINDER DEALER NEAREST YOU FOR PROMPT SERVICE.

STANLEY BERG & CO.
Pittsburgh 19, Pa.

EDMUND BURKE CO.
Toledo 2, Ohio

CHAPIN-OWEN CO. INC
Rochester 4, N. Y.

W. C. CHAPMAN & SON
Baltimore 1, Md.

DELTA EQUIPMENT CO.
Philadelphia 6, Pa.

DOROW MACHINE TOOLS
Wichita 2, Kan.

ERIE INDUSTRIAL SUPPLY CO.
Erie, Pa.

ERNST MACHINERY CO.
Kansas City 8, Mo.

IVER J. ESBENSEN CO.
Denver 4, Colo.

KENNETH J. GALM CO.
Indianapolis 4, Ind.

GENERAL EQUIPMENT & SUPPLY INC.
Miami 9, Florida

GENERAL TOOL SALES CO.
Philadelphia 40, Pa.

JOHN GORMAN
Dayton 5, Ohio

J. LEE HACKETT CO.
Detroit 11, Mich.

WM. HALPERN & CO.
New York 7, N. Y.

WALTER J. HAMMOND CO.
Minneapolis 4, Minn.

ROY J. HEYNE MACHINE CO.
Phoenix, Arizona

LEE HORNEYER CO.
St. Louis 3, Mo.

THE DONALD B. HUNTTING CO.
Cincinnati 16, Ohio

L. C. KEIR COMPANY
Seattle 4, Wash.

MORRIS MACHINERY CO.
Newark 5, N. J.

THE ROBERT E. MORRIS CO.
West Hartford 7, Conn., also
Bridgeport, Conn., & Cambridge, Mass.

R. C. NEAL CO., INC.
Buffalo 2, N. Y. also Syracuse 7, N. Y.
Rochester 4, N. Y. & Elmira Heights, N. Y.

ONONDAGA SUPPLY CO.
Syracuse 4, N. Y.

PENN GENERAL SUPPLY CO.
Pittsburgh 22, Pa.

POWELL TOOL SUPPLY INC.
South Bend 15, Ind.

PRATT & WHITNEY DIV.
Los Angeles 58, Calif. and
San Francisco 3, Calif.

RUDEL MACHINERY CO.
Montreal, Quebec

SHOP SUPPLY CO.
Birmingham, Ala.

THE STANCO COMPANY
Dallas 1, and Houston 3, Texas

STATE MACHINE TOOL CO.
Milwaukee 4, Wis.

TOOLS & ABRASIVES INC.
Fort Wayne 5, Ind.

TRI CITY MACHINE TOOL SUPPLY CO.
Rock Island, Illinois

TRI STATE MACHINERY CO.
Pittsburgh 16, Pa.

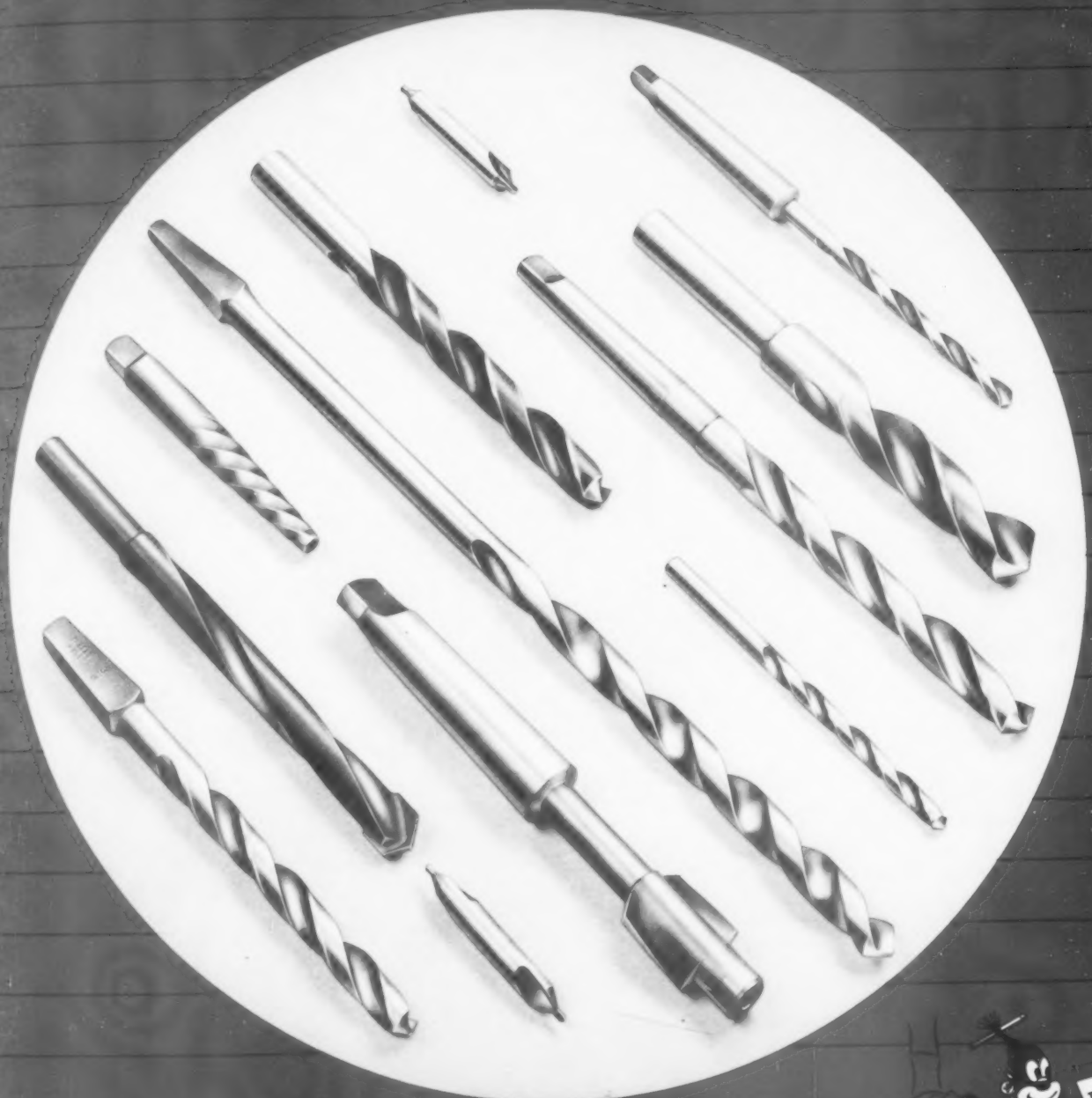
WHITAKER SALES INC.
Cleveland 15, Ohio

BOYAR-SCHULTZ CORP.

2105 WALNUT ST., CHICAGO 12, ILL.
N.Y. OFFICE: 401 BROADWAY

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-9-212

Threadwell DRILLS



THREADWELL TAP & DIE CO. Greenfield, Mass., U. S. A.

HSS DRILLING SPEEDS & FEEDS for Various Materials

For Carbon use 40% to 50% of speeds indicated

MATERIAL	SPEED IN FEET PER MIN.	DRILL DIAMETER								
		1/16 TO 1/8	5/32 TO 1/4	9/32 TO 3/8	13/32 TO 1/2	17/32 TO 3/4	25/32 TO 1	1 1/32 TO 1 1/4	1 9/32 TO 1 1/2	1 1/2 AND LARGER
		FEED PER REVOLUTION INCHES								
Aluminum	250 TO 300	.002 TO .003	.003 TO .005	.005 TO .006	.006 TO .008	.008 TO .010	.010 TO .013	.013 TO .015	.015 TO .016	.016 TO .018
Brass or Bronze	150 TO 200	.002 TO .004	.004 TO .007	.007 TO .010	.010 TO .014	.014 TO .018	.016 TO .022	.020 TO .026	.026 TO .030	.030 TO .040
Forgings: Alloy Steel	60 TO 75	.002 TO .003	.003 TO .004	.004 TO .006	.006 TO .009	.008 TO .012	.010 TO .014	.012 TO .016	.014 TO .020	.016 TO .026
Forgings: Alloy Steel Heat Treated	45 TO 60	.002 TO .003	.003 TO .004	.004 TO .005	.005 TO .006	.007 TO .010	.009 TO .012	.010 TO .014	.012 TO .016	.014 TO .022
Iron: Cast Malleable	75 TO 110	.002 TO .004	.004 TO .006	.006 TO .009	.009 TO .012	.012 TO .016	.014 TO .020	.018 TO .025	.022 TO .028	.022 TO .030
Monel Metal	60 TO 75	.002 TO .003	.003 TO .004	.004 TO .006	.006 TO .009	.008 TO .012	.010 TO .014	.012 TO .016	.014 TO .020	.016 TO .026
Steel: Carbon .2 to .3	70 TO 95	.002 TO .003	.003 TO .005	.005 TO .007	.006 TO .010	.010 TO .014	.014 TO .016	.016 TO .022	.018 TO .025	.020 TO .028
Steel: Cast Nickel, 3½%	60 TO 75	.002 TO .003	.003 TO .005	.004 TO .006	.006 TO .010	.010 TO .014	.014 TO .016	.016 TO .022	.018 TO .025	.020 TO .028
Steel: Molybdenum Stainless Tool	60 TO 75	.002 TO .003	.003 TO .004	.004 TO .006	.006 TO .009	.008 TO .012	.010 TO .014	.012 TO .016	.014 TO .020	.016 TO .026

CARBIDE DRILLING SPEEDS IN SURFACE FEET PER MIN.

MATERIAL	Drill Diam.	Speed	MATERIAL	Drill Diam.	Speed
Non-ferrous Alloys	....	150	Glass	....	20
Cast Iron (Soft)	1/8 to 7/16	70	Steel (Over 375 Brinell)	....	100
Cast Iron (Soft)	9/16 to 1	85	Plastic (Phenolic, etc.)	....	100
Cast Iron (Soft)	1 or more	125	Plastic (Glass Bonded)	....	50
Cast Iron (Chilled)	....	30	Wood	....	200

WHO IS RESPONSIBLE

for the machine-tools in your shop?

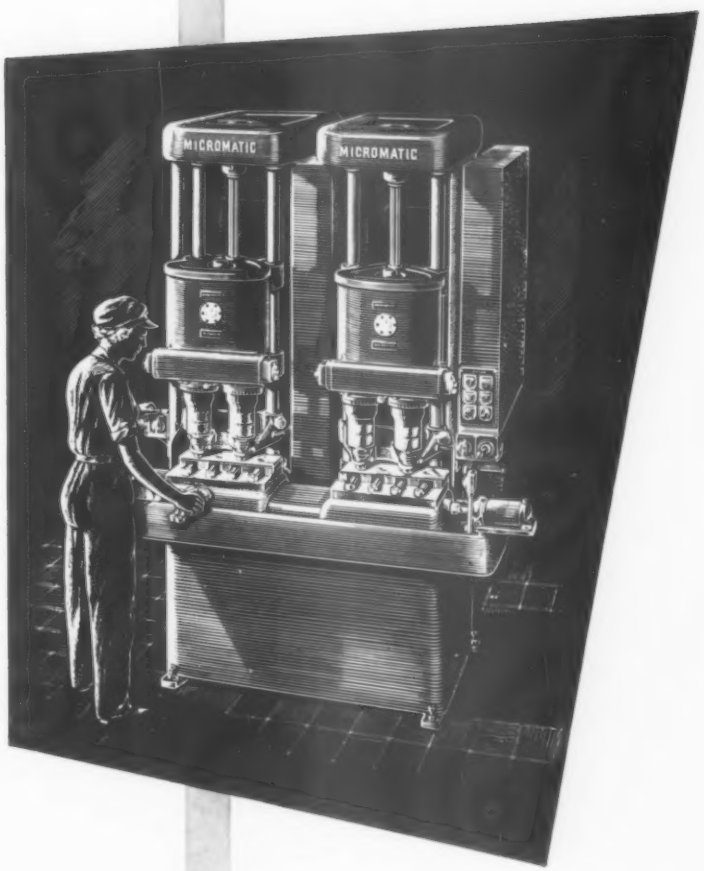
- **The dealer who sold them?**
- **The Engineering Company that designed them?**
- **The factory that built the machine, tool, or fixture?**

Where can you get complete service and satisfaction?

With users of Microhoning equipment there is no possibility of divided responsibility. One organization sells, engineers, builds, and services the complete installation. Micromatic is proud to assume full responsibility for all equipment and the results obtained with the Microhoning process.

As the leader in the development of the honing process, Micromatic offers a complete line of equipment for processing all types and sizes of cylindrical and flat surfaces.

If your problem is production, precision, or costs let our organization of experienced engineers help you.



MICRO MATIC TRADE MARK

MICROHONING MACHINES

Write for issue of CROSS HATCH describing MICROHONING MACHINES

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION • 8100 Schoolcraft, Detroit 4, Michigan

MICROMATIC HONE CORP.
MICRO-MOLD MFG. DIV.
Boston Post Road
Guilford, Connecticut

MICROMATIC HONE CORP.
614 Empire Building
26 So. Main Street
Rockford, Illinois

MICROMATIC HONE CORP.
1323 S. Santa Fe Avenue
Los Angeles 21, California

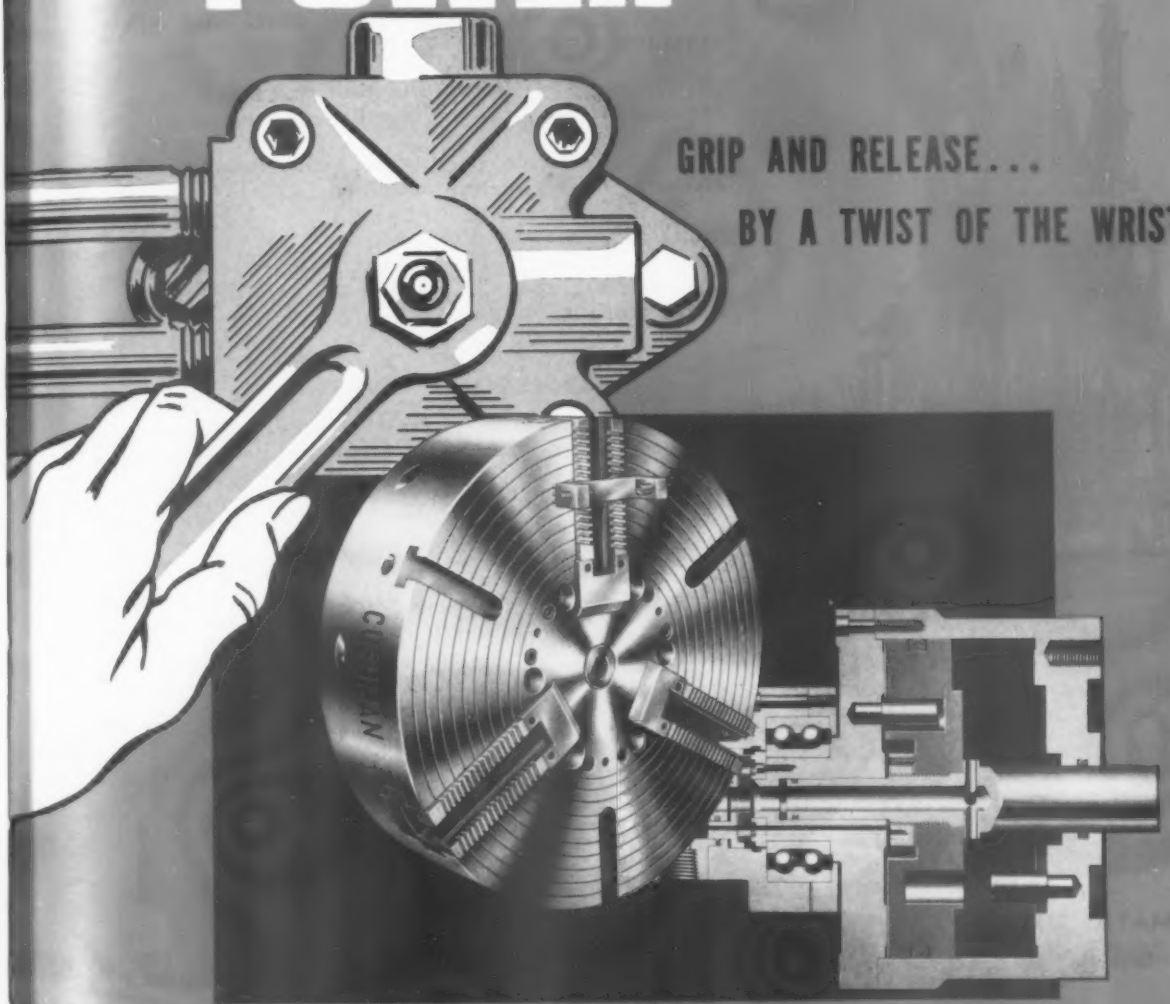
MICROMATIC HONE LTD.
55 George Street
Brantford, Ontario, Canada

MICROMATIC HONE CORP.
MICRO-MOLD MFG. DIV.
231 So. Pendleton Avenue
Pendleton, Indiana

REPRESENTATIVES: Overgard Machine Tool Company, 234 Commonwealth Bldg., Denver 2, Colorado
Hallidie Machinery Co., 2726 First Ave., South, Seattle, Wash. • REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

CONSERVE YOUR MAN-POWER

GRIP AND RELEASE...
BY A TWIST OF THE WRIST



CUSHMAN POWER CHUCKS AND ROTATING AIR CYLINDERS

Write us for a copy of the Cushman Power Chuck Catalog No. PO-64 containing complete data on all lines.

THE CUSHMAN CHUCK COMPANY . . . HARTFORD 2, CONN.

CUSHMAN ALSO MANUFACTURES MANUALLY OPERATED CHUCKS, POWER OPERATED CHUCKS AND ELECTRIC POWER WRENCHES

GYROMATIC
TAVANNES

THE IMPROVED 6 SPINDLE PRECISION

AUTOMATIC LATHE

GYROMATIC SIX-SPINDLE VERTICAL LATHE

(Shown without bar carrier and oil guards)

VERSATILE—**SIX rotating end tools and SIX cross tool slides.**

ECONOMICAL—**Both in tooling and set-up expense; uses comparatively little floor space.**

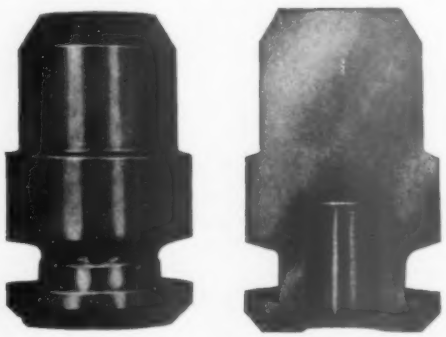
EFFICIENT—**High production, with built-in precision to meet exacting standards.**

UNIQUE DESIGN—**Vertical arrangement reduces wear of moving parts. Gravity bar feed requires no feed fingers, reduces load on spindles, minimizes vibration and noise.**

CHUCKING OPERATIONS

. . . can also be performed to great advantage. Vertical design permits easier loading and holding of work pieces.

Typical work piece taken from bars; capacity of 2⅝" dia. and 6" long.



AMERICAN REPRESENTATIVES

(UNITED STATES—EXCEPT WEST COAST)

RUSSELL, HOLBROOK & HENDERSON, INC.

292 MADISON AVENUE, NEW YORK 17, N. Y.

(CALIFORNIA, OREGON, WASHINGTON)

ART THOMAS MACHINERY CO.

2820 LEONIS BLVD., LOS ANGELES, CALIF.

take a new look at your Gear Shaper Cutters!

SEE HOW TO INCREASE GEAR PRODUCTION AND DECREASE TOOL COSTS!

ILLINOIS

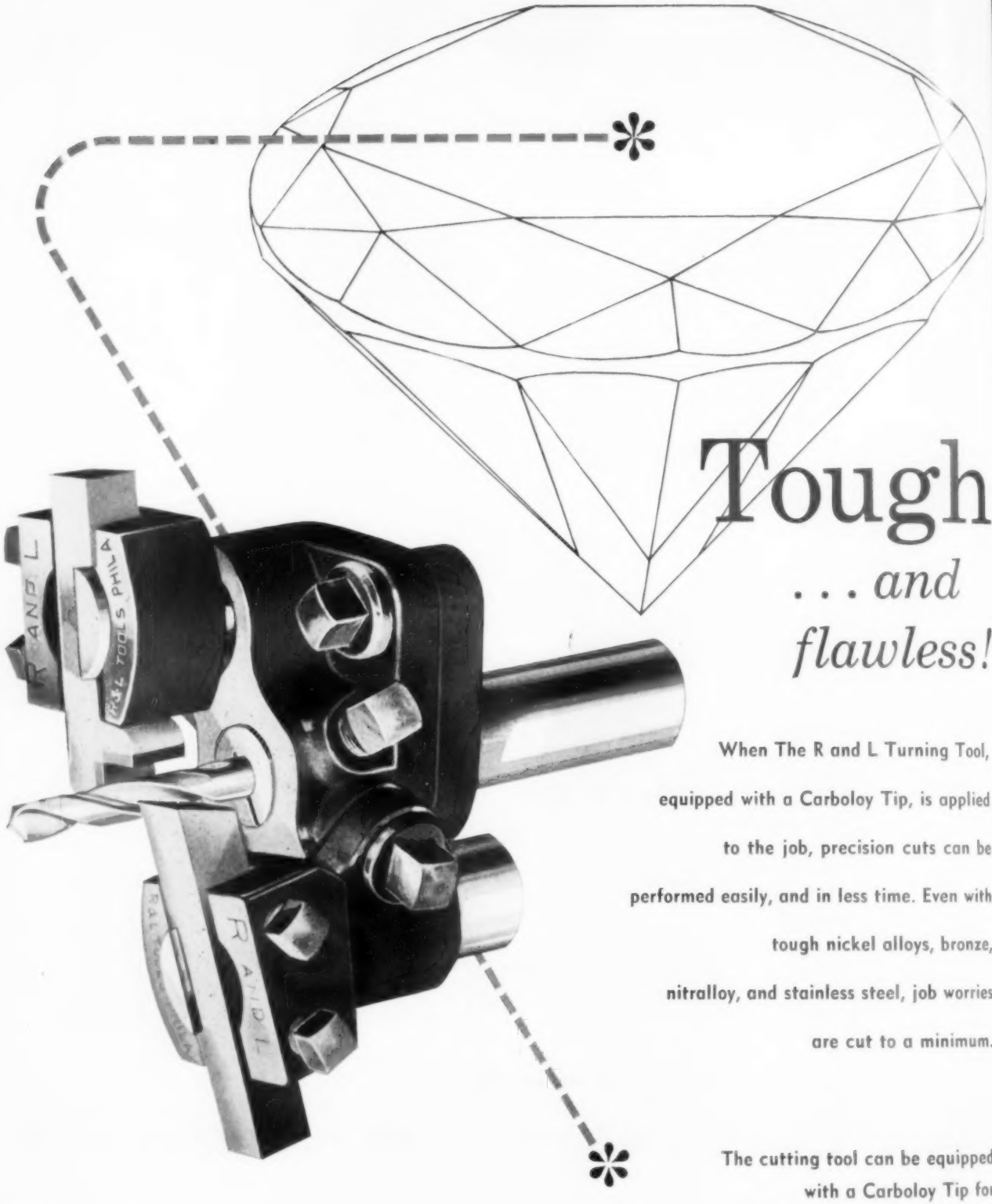
TOOL WORKS

Understand the real function of the gear shaper cutters you use—their broad range of application and how their cutting life can be extended. Check the advantages of cutter design modifications in meeting special gear requirements. See how specific engineering of gear shaper cutters can be important in your cost picture!

For longer life, in mass production or job lots, specify ILLINOIS engineered Gear Shaper Cutters!

Illinois Tool Works, 2501 No. Keeler Avenue, Chicago 39, Ill.

"HEADQUARTERS FOR ENGINEERED CUTTING TOOLS"



Tough
. . . and flawless!

When The R and L Turning Tool, equipped with a Carboloy Tip, is applied to the job, precision cuts can be performed easily, and in less time. Even with tough nickel alloys, bronze, nitralloy, and stainless steel, job worries are cut to a minimum.

The cutting tool can be equipped with a Carboloy Tip for difficult job requirements.

Write today for the complete R and L Catalog

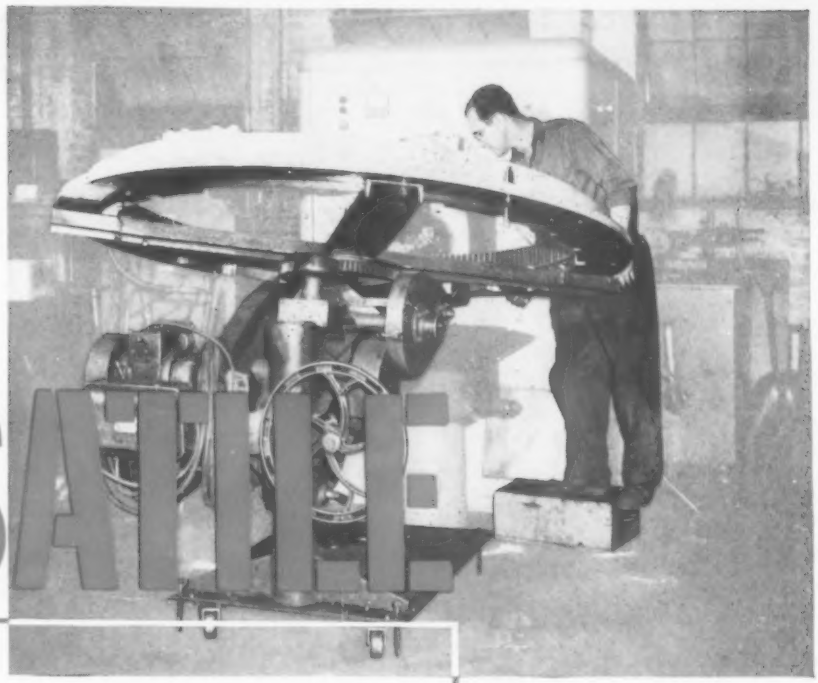
RIGHT R and L LEFT **TOOLS**

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

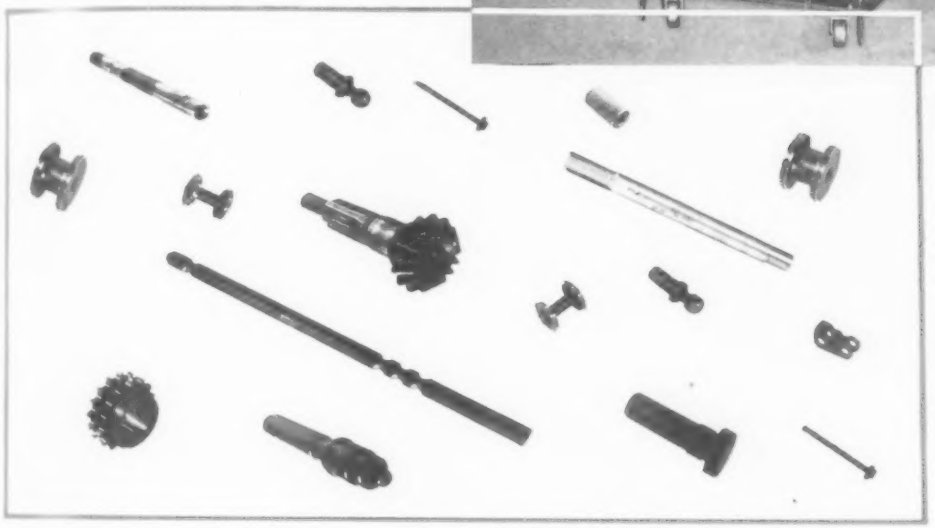
TURNING TOOL • TAP AND DIE HOLDER • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL
RELEASING ACORN DIE HOLDER • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL • CARBIDE AND ROLLER BACKRESTS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-220

VERSATILE



"Internal ring gear being hardened on the Lindberg LI-25 Induction Heating Unit".



Investigate the amazing versatility of the Lindberg Induction Heating Unit—approximately 2000 different parts have been selectively hardened or annealed on this typical commercial heat treating installation.

FROM THE LARGEST—The internal ring gear illustrated above—with a 60" inside diameter, 3½" face with 187 teeth each individually heated and oil spray quenched.

TO THE SMALLEST—This small 2" stamped metal rocker arm was selectively heated and water quenched on the small square face at the rate of 3000 per hour. Investigate this versatile Lindberg Induction Heating Unit—it may supply the answer to your selective heating operations.

SPECIFY LINDBERG

For any heat treating or melting need! Lindberg manufactures every type and many sizes of melting and heat treating furnaces from tiny laboratory units to mammoth field erected installations—whether it's gas, oil, electric, arc, low or high frequency—consult your local Lindberg Office!

LINDBERG
HIGH FREQUENCY DIVISION

LINDBERG ENGINEERING COMPANY 2466 W. Hubbard Street, Chicago 12, Illinois

IT'S HIS JOB TO HELP YOU SAVE TIME AND MONEY

Consistent top performance is only one of the advantages of using Card Taps. You also get a lot of practical know-how covering the range of tapping applications.

That's supplied by Card's staff of factory representatives — men whose extensive training and field experience qualify them to handle the toughest cutting tool problems.

Very likely a Card representative can come up with suggestions that will benefit your own production. He's always available for advice on any tapping operation, present or planned. S. W. CARD MANUFACTURING COMPANY, Mansfield, Massachusetts, DIVISION OF UNION TWIST DRILL CO.

ASK YOUR CARD DISTRIBUTOR FOR COMPLETE DETAILS

The CARD Quality

TAPS

Also makers of DIES • SCREW PLATES • DIE STOCKS TAP WRENCHES

Proof of Precision

that means tighter fastening!

See the unique multiple-spline socket in that large 1-inch Bristol Socket Screw.

You'll find this same exclusive Bristol feature (vital to *tighter* tightening) in every one of the 7,438 tiny No. 0 Bristol Socket Screws held in that 2 oz shot glass.

It takes precise machinery . . . painstaking effort . . . to make them that way. But it's worth it . . . to give you shock-resistant fasteners, precise enough to be used in electric razors, cameras, communications devices, instruments of all kinds.

The multiple-spline socket permits tightening beyond limit of ordinary screws . . . turns internal wrenching force into *rotary motion*, not expanding pressure. Hence, no bursting, no rounding out of socket walls—even in sizes down to No. 3, 2, 1, 0 wire size. *Result:* maximum resistance to vibration.

Other advantages: ideal for compact assemblies and hard-to-get-at fastening points. For disassembly, a reverse flick of wrench loosens the set.

Only BRISTOL *gives you the right socket screw for every application*

BRISTOL'S

Multiple-Spline and Hex Socket Screws...Cap and Set

SEND COUPON FOR FREE SAMPLES —also helpful bulletins on designing compact, tight assemblies.

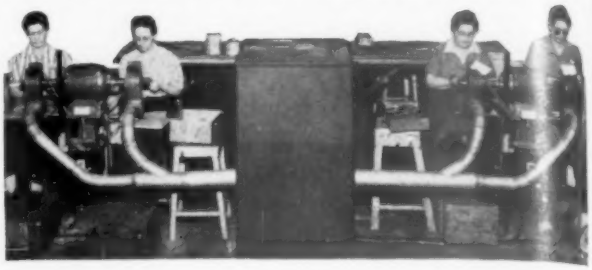
The Bristol Company
Mill Supplies Division
131 Bristol Road, Waterbury 20, Conn.

Please send me free sample of Bristol's Multiple-Spline Screw and bulletins showing applications to:

NAME_____ TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____
Screw Sizes_____
Our problem is mainly_____ VIBRATION ☐
COMPACT DESIGN ☐ FREQUENT TAKE-APART ☐

USE READER SERVICE CARD; INDICATE A-9-224-1

A TORIT DUST COLLECTOR . . .



at Four to One Still Your Best Bet!

TORIT FB TYPE Dust Separator

Torit also manufactures a line of cyclone type dust separators. Sizes up to 5 H.P., with or without after-filters.

Here four grinding wheels are in constant use finishing small parts, yet this 1½ H.P. Model 81 Torit Dust Collector completely eliminates any abrasive dust hazard to operators or to finished parts.

The efficient, self-contained design of Torit Dust Collectors permits compact set ups like this. There is no work interference, piping is minimized, and operating costs are low because this Torit Dust Collector runs only when the wheels are in operation.

Solve *your* dust problems with Torit Dust Collectors. Models and sizes for standard and special dust-collecting problems. Ask for details and the latest Torit catalog.

TORIT

MANUFACTURING CO.
281 Walnut St. St. Paul 2, Minn.

USE READER SERVICE CARD; INDICATE A-9-224-2

"The doorway to better engineering."

PARAMOUNT ENGINEERING COMPANY

1625 E. GRAND BOULEVARD
DETROIT 11, MICHIGAN
WALNUT 1-6040

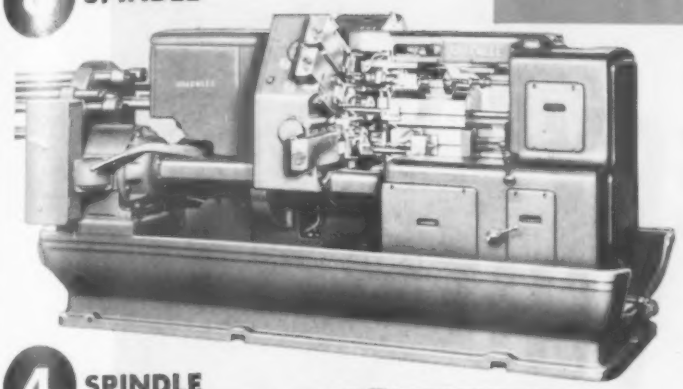
Our Service Includes

- Consulting Engineering Services
- Product Development
- Body and Chassis Engineering
- Plant Layout
- Processing
- Time Study
- Designing Dies and Tools, Jigs and Fixtures, Gages and Special Machines
- Expediting
- Graphic Engineering
- Make Wood Patterns, Models, and Mock-ups

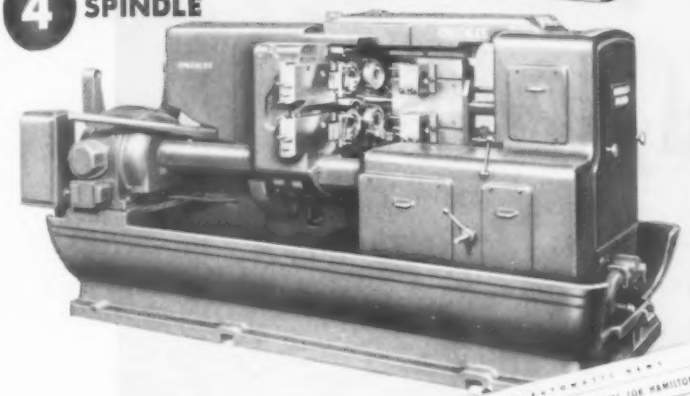
USE READER SERVICE CARD; INDICATE A-9-224-3

GREENLEE AUTOMATICS

6 SPINDLE



4 SPINDLE



Maximum economy of operation on long-run jobs, with an uncluttered, easily-reached tooling area that allows rapid and accurate positioning of tools and attachments . . . permitting precise inspection of work finish and tolerances *on the machine.* The Greenlee "Six" is available in 1″, 1-5/8″, and 2″ capacity — the "Four" in 1-5/8″ and 2-5/8″ capacity.

PRODUCTION MACHINERY

GREENLEE

Automatic News

These free monthly issues are written expressly for those of you who are concerned with various phases of automatic screw machine production. They contain practical and informative articles dealing with tooling and maintenance, generously illustrated with drawings and photographs. If you wish your name added to our mailing list, send your request, on company letterhead, to:

The Editor, *Automatic News*

GREENLEE BROS. & CO.
1989 Mason Ave., Rockford, Illinois

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

CANNY CARBIDE USERS:

CONSERVE DIAMOND WHEELS with preformed ADAMAS Carbide

The National Production Authority order M-103 severly restricts the use of diamond wheels by: 1) limiting offhand rough grinding and finishing with resinoid bonded wheels, 2) curtailing inventories to 60 day periods, 3) requiring the use of coolant on all diamond wheel grinding, 4) allowing a maximum of ⅛" depth of diamond and 100 concentration on all wheels.

U. S. DEPARTMENT OF COMMERCE
NATIONAL PRODUCTION AUTHORITY

M–103
MARCH 13, 1952

TITLE 32A—NATIONAL DEFENSE, APPENDIX

Chapter VI—National Production Authority, Department of Commerce

[NPA Order M–103 of March 13, 1952]

M–103—DIAMOND GRINDING WHEELS

This order is found necessary and appropriate to promote the national defense and is issued under the authority granted by the Defense Production Act of 1950, as amended. In the formulation of this order there has been consultation with industry representatives, [illegible]

controlled directly by hand and not by precision mechanical means.

(f) "Rough grinding" means the heavy removal of stock without regard to finish.

(g) "Finish grinding" means the final grinding to desired size and finish.

(h) "Profile grinding" means grinding to a predetermined shape controlled by a form or template.

(i) "Wet grinding" means a method whereby a flood of coolant or lubricant flows on the diamond wheel and the work.

(j) "Wick grinding" means a method whereby a sufficient quantity of coolant or lubricant is supplied to a wick in contact with a diamond grinding wheel such wheel adequately wet.

This regulation will impose no real hardship if you specify ADAMAS preformed blanks because:

★ Careful and accurate preforming to close tolerances assures *minimum stock removal.*

Additional advantages are:

★ *Labor savings*...fewer man-hours required for grinding.

★ *Minimize breakage*...eliminates danger of cracking as a result of overheating.

★ *Conservation*...precious diamond wheels are saved for really important finishing jobs.

★ *Economy*...preforming is done inexpensively by ADAMAS in soft material saving you costly wheels.

***Delivery of ADAMAS** preformed blanks is now scheduled to help in this shortage. An inquiry will quickly demonstrate speed of delivery and economical pricing. If ADAMAS standard blanks fit your requirements, they can be obtained immediately from stock.*

I'd like the new ADAMAS catalog and price list for ordering standard and special tool tips.

Name .....

Title .....

Company .....

Address .....

.....

ADAMAS CARBIDE CORPORATION
HARRISON, NEW JERSEY

PRODUCERS OF TUNGSTEN CARBIDE TOOL TIPS, DIES AND WEAR PARTS

tool steel is our fair-haired boy!

We are definitely partial toward *our* tool steel. Especially since users have verified our opinion of them by making us the country's number one producer of fine tool steel.

Naturally, we intend to maintain this position. Therefore, Crucible research and development is forging ahead, supplying industry's need for new, improved tool steels . . . Crucible makes its long experience freely available to you through its metallurgical service . . . And Crucible provides you with prompt delivery of tool steel, from its completely stocked warehouses, conveniently near you.

SEND TODAY for the unique Crucible Tool Steel Selector—a twist of the dial gives the tool steel for your application.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
Atha Pneu

SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES

Crucible Steel Company of America
Dept. T, Chrysler Building, New York 17, N. Y.
Name_____
Company_____ Title_____
Address_____ City_____ State_____

9" diameter, 3-colors

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

TOOL STEELS

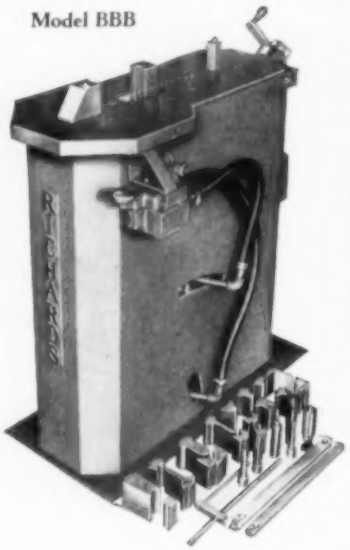
UCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-227

MULTIFORM BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅜"x1½" material.

Send for illustrated folder TE-5

J. A. RICHARDS CO. 903 North Pitcher St. Kalamazoo, Michigan

USE READER SERVICE CARD; INDICATE A-9-228-1

EXTRA LONG LENGTH High Speed Drills

IMMEDIATE DELIVERY!

12" Overall 9" Flute Straight Shank

Size Inches	Price Each Net	Size Inches	Price Each Net	Size Inches	Price Each Net
1/8	$1.65	15/64	$1.95	3/8	$2.75
9/64	1.65	1/4	1.95	25/64	3.05
5/32	1.65	17/64	2.05	13/32	3.05
11/64	1.65	9/32	2.05	27/64	3.30
3/16	1.65	19/64	2.25	7/16	3.30
13/64	1.80	15/16	2.25	29/64	3.60
7/32	1.80	21/64	2.50	15/32	3.60
		11/32	2.50	31/64	3.60
		23/64	2.75	1/2	3.60

1 to 60 S.S. 4" to 6" long H.S. Drills

VICTOR MACHINERY EXCHANGE, INC.

DEALERS IN TOOL ROOM EQUIPMENT

251-D Centre St., New York 13, N. Y. • Phone CAnal 6-5575

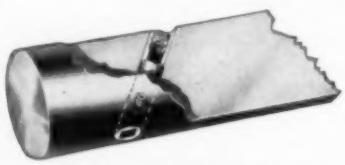
USE READER SERVICE CARD; INDICATE A-9-228-3

To Obtain Further Information About Advertisers, Trade Literature or Tools of Today Appearing in this Issue of The Tool Engineer, Use the Handy Readers Service Card on Page 101.

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!

Patents Pending

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.



The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

BUSHINGS MADE IN FOLLOWING SIZES: 3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

•

STURDY BROACHING SERVICE

23520 TELEGRAPH RD., DETROIT 19, MICH.

Write for Literature

USE READER SERVICE CARD; INDICATE A-9-228-2

THE Way TO MAKE SET-UPS FASTER

In these days of rising labor costs, saving time on any operation is becoming increasingly important, because saving time means saving money.

On tapping and reaming jobs, for example, you will find that you can save considerable time in aligning the work with the spindle by using a Ziegler Tool Holder instead of an ordinary tool holder.

Because of its floating action, the Ziegler automatically compensates for inaccuracies in spindle alignment up to 1/32" radius, or 1/16" diameter. It is therefore unnecessary to spend as much time as is required in making the setup with ordinary tool holders in order to insure against oversize and bell-mouthed holes.

Get a Ziegler Floating Holder and see for yourself how much time it saves.

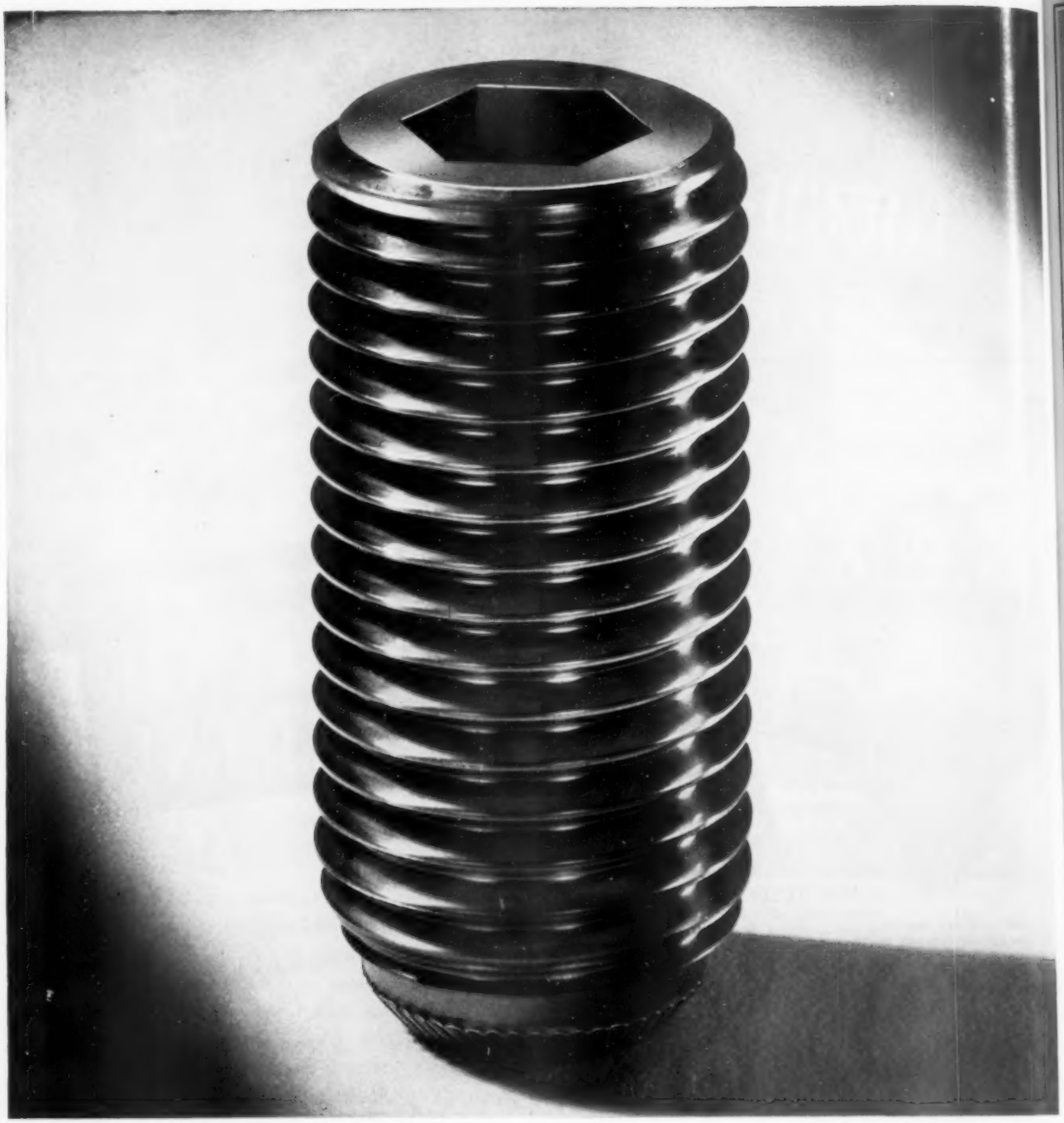
W. M. ZIEGLER TOOL COMPANY

13574 Auburn Detroit 23, Mich.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-9-228-4



For positive, vibration-resistant SELF-LOCKING UNBRAKO SOCKET SET SCREWS

UNBRAKO Self-Locking Socket Set Screws won't work loose. Non-slip internal wrenching provides positive drive. Self-locking feature prevents creep and subsequent loosening. Machinery stoppage and production losses are materially reduced. Write for descriptive literature. STANDARD PRESSED STEEL Co., Jenkintown 37, Pennsylvania.

Standard UNBRAKO *Self-Locking Set Screws, #4 to 1" inclusive, are available from your* UNBRAKO *distributor's stocks. Ask him for your supply of these and other* UNBRAKO *threaded industrial fasteners.*

SPS JENKINTOWN, PENNSYLVANIA

UNBRAKO SOCKET SCREW DIVISION

CAP SCREWS • SET SCREWS • SHOULDER SCREWS • DOWEL PINS • PRESSURE PLUGS

FOR ECONOMY

PRECISION MACHINES PM PARKER · MAJESTIC

PARKER-MAJESTIC GRINDERS

WITH THE ADJUSTABLE

TABLE RECIPROCATING MECHANISM*

Give Smoother Performance

AND GREATER ACCURACY

OUTSTANDING FEATURES

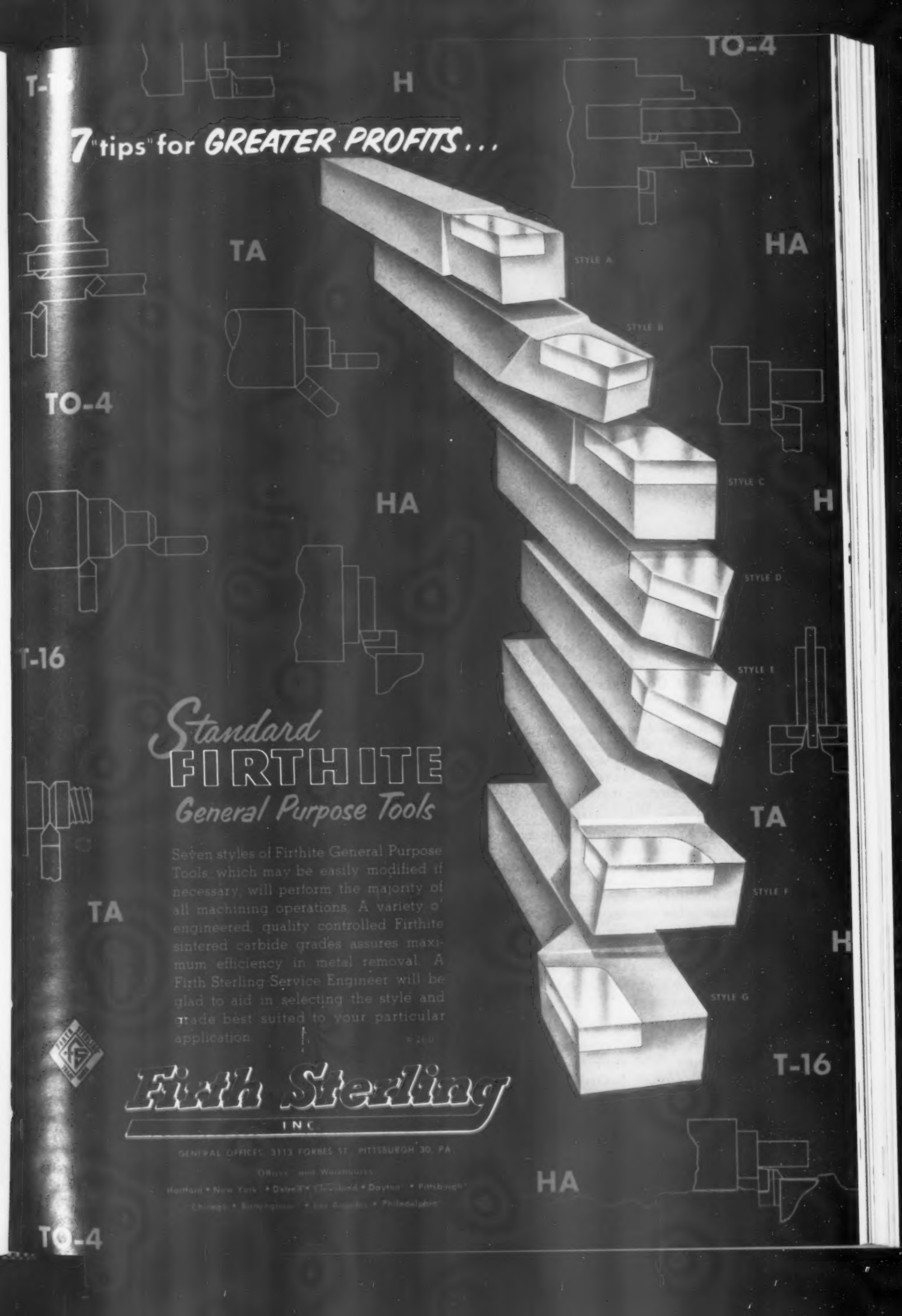
1. **Positive Mechanical Operation.**
2. **Reciprocating Table travel adjustable from 0" to 3".**
3. **Rapid and accurate table movement.**
4. **Four table speeds—15, 30, 45 & 60 reversals per minute.**

**Optional equipment with most models of Parker-Majestic Internal or External Grinders.*

PARKER-MAJESTIC, INC.

formerly Majestic Tool & Mfg. Co.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN


7 "tips" for GREATER PROFITS...
T-16
H
TO-4
TA
HA
STYLE A
STYLE B
STYLE C
STYLE D
STYLE E
STYLE F
STYLE G
Standard
FIRTHITE
General Purpose Tools
Seven styles of Firthite General Purpose Tools, which may be easily modified if necessary, will perform the majority of all machining operations. A variety of engineered, quality controlled Firthite sintered carbide grades assures maximum efficiency in metal removal. A Firth Sterling Service Engineer will be glad to aid in selecting the style and grade best suited to your particular application.
Firth Sterling
INC.
GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MULTIPRESS®

solves another "tough one"

Feeds and Forms hard-to-handle plastic with automatic accuracy

U. S. Gasket Co. gets quality plus speed in compacting parts from Du Pont's Teflon

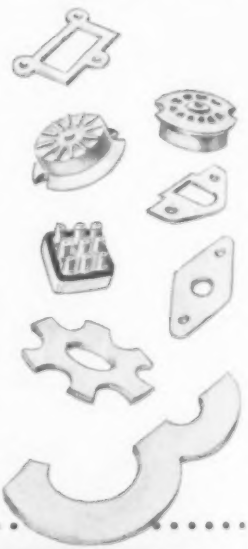
Toughness and high heat-resistance make Du Pont's Teflon an ideal plastic for many needs. But feeding the raw material to molding dies has been a problem; the granules tend to cling together in a non-fluid mass.

MULTIPRESS solved the feeding problem with its unique, shuttle-type, self-agitating feed attachment. In addition, the smooth, oil-hydraulic operation and fully adjustable ram action of Multipress brought other production gains. At cost-cutting production speeds, compacting is done with *automatically uniform results*—a necessity because most Teflon parts made at U. S. Gasket must pass micrometer tests for close-tolerance requirements.

Quick tool-changing and easy adjustment of ram stroke, speed and pressure are further advantages. With more than a thousand different dies, U. S. Gasket switches four Multipresses from one group of short-run jobs to another with minimum loss of production time.

Another feature this manufacturer likes is that Multipress provides a bottom ram to apply pressures upward giving equal pressures on top *and* bottom of parts. The four automatic Multipresses now in use at U. S. Gasket—a 25-ton, a 15-ton and two 8-ton units—are all equipped for this "double-end" ram action.

Multipress is getting better results for hundreds of manufacturers, in many different fields, because it provides smooth, rapid, low-impact pressures under accurate control—easily adjustable to the exact need. Eight frame sizes available . . . one-ton to 50-ton capacities . . . auxiliary equipment for many special needs. Write for full details.



THE **DENISON** DENISON Hydraulics

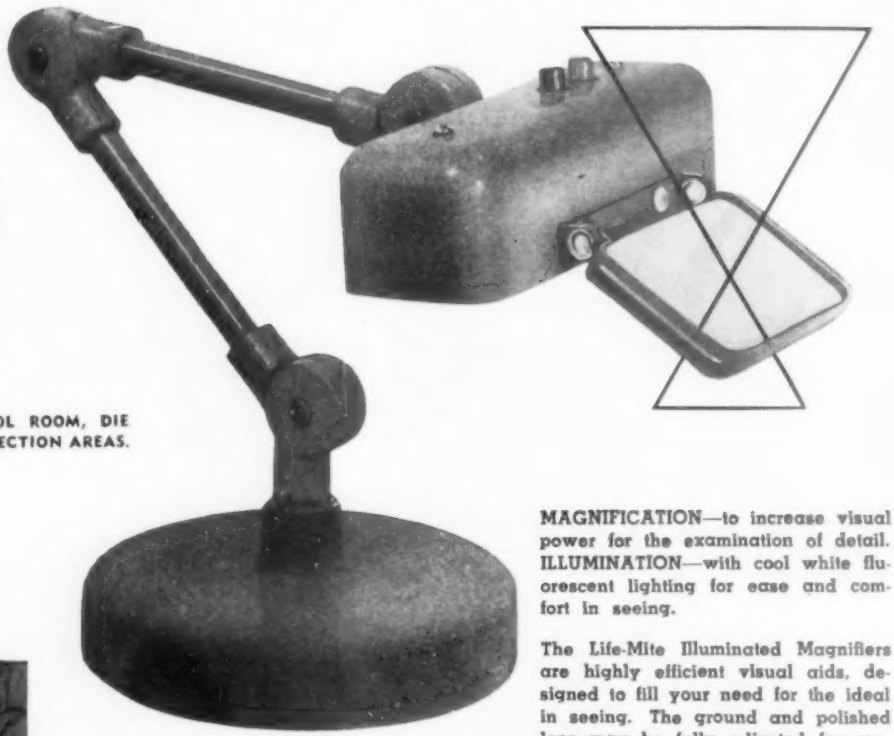
ENGINEERING COMPANY

1191 Dublin Rd. Columbus 16, Ohio

for precision TURNING, SPINNING, FINE WORK.

for accurate CONTOUR SAWING, FILING, GRINDING.

Lite-Mite FLUORESCENT ILLUMINATED MAGNIFIER*



for countless uses in TOOL ROOM, DIE SHOP, ASSEMBLY and INSPECTION AREAS.

MAGNIFICATION—to increase visual power for the examination of detail. **ILLUMINATION**—with cool white fluorescent lighting for ease and comfort in seeing.

The Life-Mite Illuminated Magnifiers are highly efficient visual aids, designed to fill your need for the ideal in seeing. The ground and polished lens may be fully adjusted for convenient use. Swivel joints at the head, base and at each arm joint assure ease in mounting to nearly any machine, bench or device.

for fussy GRINDING, MILLING, SHAPING.

*Twin Fluorescent Lamps furnish Ideal Illumination.

Stocker & Yale Lite-Mite fluorescent bench and machine lights, as well as industrial Contour Projectors and Optical Measuring Instruments, are designed to give the finest possible performance at the lowest possible cost. It will pay to investigate these products further. Write today.

Stocker & Yale
INCORPORATED

MARBLEHEAD, MASS.

Lite-Mite LOCALIZED LIGHTING
Precision INSPECTION INSTRUMENTS

Miniature OPTICAL PROJECTORS
S & Y TAP ANALYZER

MALCOMIZING

FOR SURFACE HARDENING STAINLESS STEELS

CALL *LINDBERG STEEL TREATING CO.*

It'll pay you to investigate Malcomizing if you use surface hardened stainless steel parts in your finished product. Malcomizing imparts increased wear resistance, increased abrasion resistance, increased corrosion resistance and increased erosion resistance to stainless steels.

Hundreds of manufacturers from coast to coast have found that Malcomizing means improved results . . . longer product life . . . better performance . . . finer finished products.

- Malcomizing increased hot press die runs from 100% to 300%!
- Malcomizing improved wearing quality of wire guides . . . 10 to 1!
- Malcomizing eliminated damaging erosion and corrosion of air pump piston and connecting rods!
- Malcomizing resisted moisture condensation and eliminated rust that formerly caused failure on aerial camera valves!
- Malcomizing increased wear resistance of governor valves and valve seats for steam turbines!
- Malcomizing improved the corrosion resistance of movie projector parts subject to adverse climatic conditions!

Get your copy of the Malcomizing booklet. It discusses types of steels that can be Malcomized . . . suggested heat treatments before Malcomizing . . . selective Malcomizing . . . case depths . . . stability at elevated temperatures . . . corrosion resistance . . . and the passivation of Malcomized steels.

For the complete story of this product-improving, money-saving process, ask for your copy of the new 28 page booklet, "Malcomizing".

Plants in

CHICAGO
222 N. Laflin
MOnroe 6-3308

ROCHESTER
620 Buffalo Rd.
GEnessee 5213

ST. LOUIS
650 E. Taylor
Fireside 6200

LOS ANGELES
3537 East 16th St.
ANgelus 6724

LINDBERG STEEL TREATING CO.

222 North Laflin Street, Chicago 7, Illinois Phone: MOnroe 6-3308

AIR CYLINDERS

Benefits to You

No Broken Castings
No Scratch-Damage to Piston Rods, Bushings and Seals

NO COSTLY "DOWNTIME"
NO REPAIRS
NO MAINTENANCE
NO POWER WASTAGE

Sales and Service from coast to coast

FOUR-WEEK DELIVERY

To Meet Your

RUSH

Cylinder Requirements

. . . now assured by our modern new plant with greatly expanded facilities—devoted exclusively to the manufacture of quality cylinders.

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

MILLER MOTOR COMPANY

2010 N. HAWTHORNE AVE. • MELROSE PARK, ILL.

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR HOISTS

CLEVELAND—YOUNGSTOWN—DAYTON—PITTSBURGH—PHILADELPHIA—BOSTON—HARTFORD—NEW YORK CITY—BUFFALO—ST. PAUL—GRAND RAPIDS—DETROIT—FLINT—FORT WAYNE—SOUTH BEND INDIANAPOLIS—MILWAUKEE—LOUISVILLE—KANSAS CITY—SEATTLE—LOS ANGELES—SAN FRANCISCO—BALTIMORE—DENVER—ST. LOUIS—MOLINE—CHICAGO—HOUSTON—TORONTO, CANADA and OTHER AREAS

20th Annual Meeting Papers Still Available!

The following technical papers, delivered in Chicago at the 20th Annual Meeting, are ready for immediate distribution. Mail your order today!

Paper No.	*Title*
S1	Criteria for Selecting Sampling Methods
S2	Fixed Gage Standards and Pracice
S3	Production Line Hardness Testing
S4	Speed and Feed Selection for Efficient Drilling
S5	Precision Hole Location Methods
S6	Drill Jig Design for Secondary Operations
S7	Die Design for Metal Blanking
S8	Die Design for Metal Drawing
S9	Selection and Treatment of Die Steels
S10	Automatic Size Control in Finish Grinding
S11	Precision Production Grinding
S12	Finish Grinding Troubles and Remedies
S13	Electronics in Motor Drives
S14	The Tool Engineer Chooses Pneumatic or Hydraulic Drives
S15	Mechanical Variable-Speed Drives
T1	Cooperation Between Research Centers and Engineering Societies
T2	The Function of Cutting Fluids in Modern High-Speed Machining
T3A	Relation of the Tool Engineer to Company Standards
T3B	The Part of Standards in Better Customer Relations
T4	Production Grinding of Cylindrical Parts Requiring Extreme Precision
T5	Producing Deep Holes by Trepanning and Drilling
T6	Broaching of Internal Gears
T7	Job-Tests Aid Production Personnel
T8A	New Precision Reference Specimens for Surface Finish Control
T8B	The Surfagage—An Instrument for Roughness Measurement

Paper No.	*Title*
T9	An Analysis of Cost Estimating Principles and Practices
T10	Recent Advances in Metal Cutting Science and Practice
T11	Electro-Mechanical Machining of Hard Materials
T12	Tool Engineers and Electroforming
T13	Heat-Treating and Machining of Boron Steels
T14	New Developments in Cemented Carbides
T15	Multiple Screw Machine Tooling and Methods
T16	Power Chucking
T17	Strength of Bolted Assemblies
T18	Practical Aspects of Tool and Die Heat-Treatment
T19	Contour Milling of Sheet Stock
T20	Sand Casting with Croning Process Shell Molds
T21	Cupola Deoxidation Improves Machinability of Iron Castings
T22	Control of Quality on Mass-produced Engineering Parts
T23	Dynatomics—A New Concept in Metal Removal
T24	Improved Measurements as a Way Towards Safer Tolerances

Panel Discussions

Paper No.	*Title*
LS1P	Turning and Forming Tolerances
LS2P	Drilling
LS3P	Metal Stamping Dies and Operations
LS4P	Finish Grinding
LS5P	Machine Drives and Controls

Individual Papers, each **.50**

(Discussions on papers are included at no extra charge.)

Panel Discussions, each **1.00**

Complete set of ASTE 1952 Collected Papers, including all papers, written discussions and edited transcripts of all panel discussions, each **5.00**

Full payment must accompany orders.

ASTE COLLECTED PAPERS
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 Puritan Ave., Detroit, Michigan

Please send postpaid the 20th Annual Meeting papers I have circled below:

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14
S15 T1 T2 T3A T3B T4 T5 T6 T7 T8A T8B T9 T10 T11 T12
T13 T14 T15 T16 T17 T18 T19 T20 T21 T22 T23 T24
LS1P LS2P LS3P LS4P LS5P

Name .....

Title .....

Company .....

Street .....

City ..... Zone ..... State .....

faster set-ups, greater accuracy assured by SCAN-A-SCALES

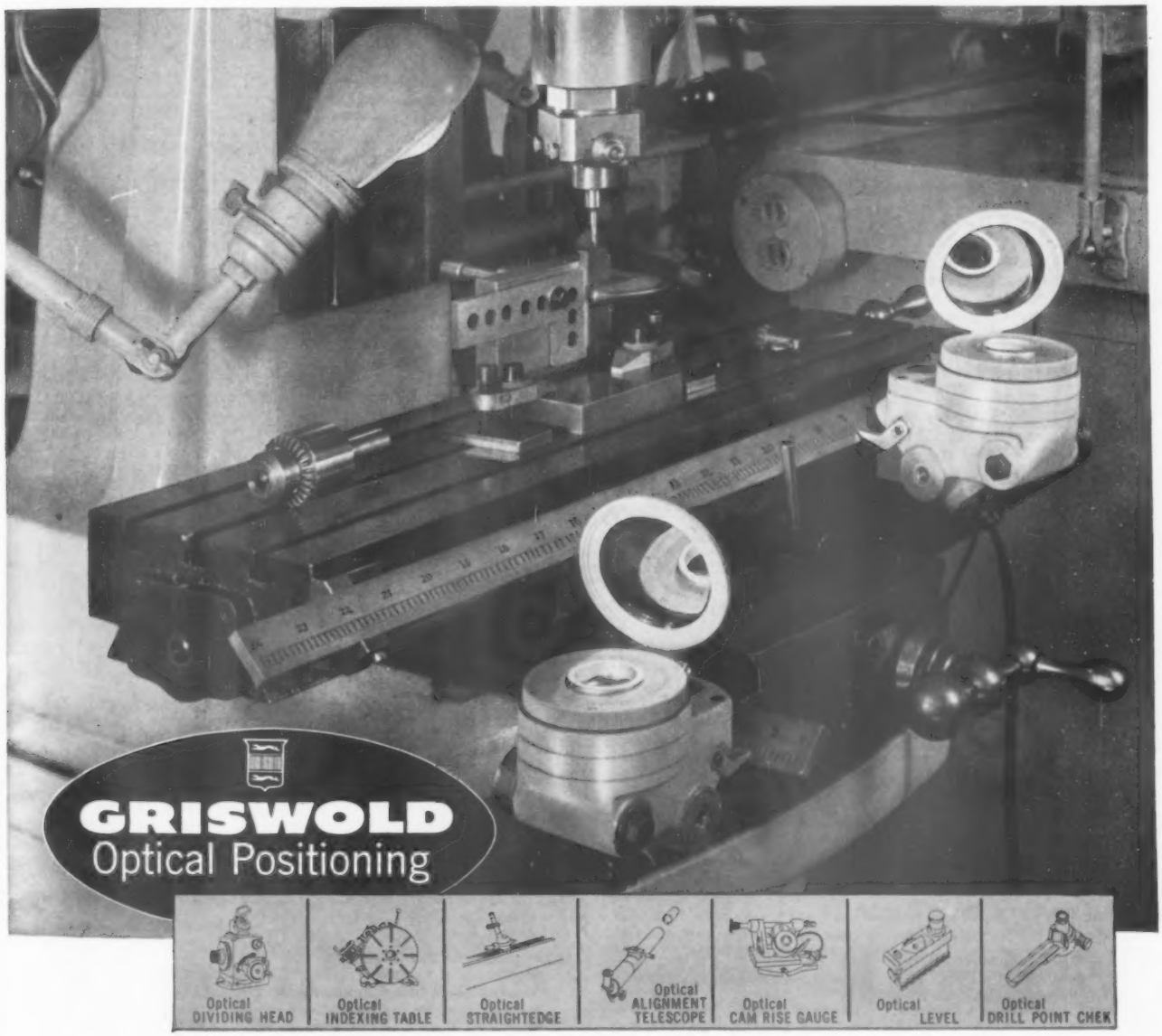
MAKES A PRECISE MACHINE OF THIS LOW COST JIG BORER

Jacques Kreisler Manufacturing Company, world famous manufacturer of watch bands, have mounted Scan-A-Scales on a jig borer in their tool and die shop. Faster set-ups and greater accuracy is now assured over the micrometer settings formerly used. According to Methods Supervisor, Eric Sundberg, Scan-A-Scales have transformed one of their low cost jig borers into a precise, reliable machine. Accuracies to ±.0002" and even closer can be expected.

Scan-A-Scales provide precise and simple methods of making linear measurements on machine tools and permit direct visual settings with the advantages only optical precision can give. They eliminate inaccuracies due to variations in pressure found in micrometers and loose standards. No attention to lead screw settings and no focusing is required.

Because Scan-A-Scales speed work and increase accuracy, machine tool manufacturers are now including them as original equipment. You too can get these real benefits by installing Scan-A-Scales on new and old machines in your shop.

Write today for your free copy of our new illustrated catalog. F. T. Griswold Mfg. Co., Wayne 2, Pa.



Index of The Tool Engineer Advertisers

September, 1952

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1952 ASTE Industrial Exposition

♦Technical Data Available in ASTE Data Sheets

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN
Austin G. Cragg
400 Madison Ave.
Phone: Plaza 9-4018
New York 17, New York

OHIO
Richard E. Cleary
Commercial Bank Building
Phone: Berea 4-7719
Berea, Ohio

CENTRAL
Clarence T. Etter
10700 Puritan Avenue
Phone: University 4-7300
Detroit 21, Michigan

WESTERN
Stanley F. Girard
540 N. Michigan Ave.
Phone: Michigan 2-4465
Chicago 11, Illinois

PACIFIC COAST
W. R. McIntyre
423 First Trust Bldg.
Phone: Ryan 1-6981
Pasadena 1, California

Benco Pushers

stay on the job

Longer

Your total machine output is vitally dependent on the quality of your pushers because low production and high stock waste results from inferior pushers.

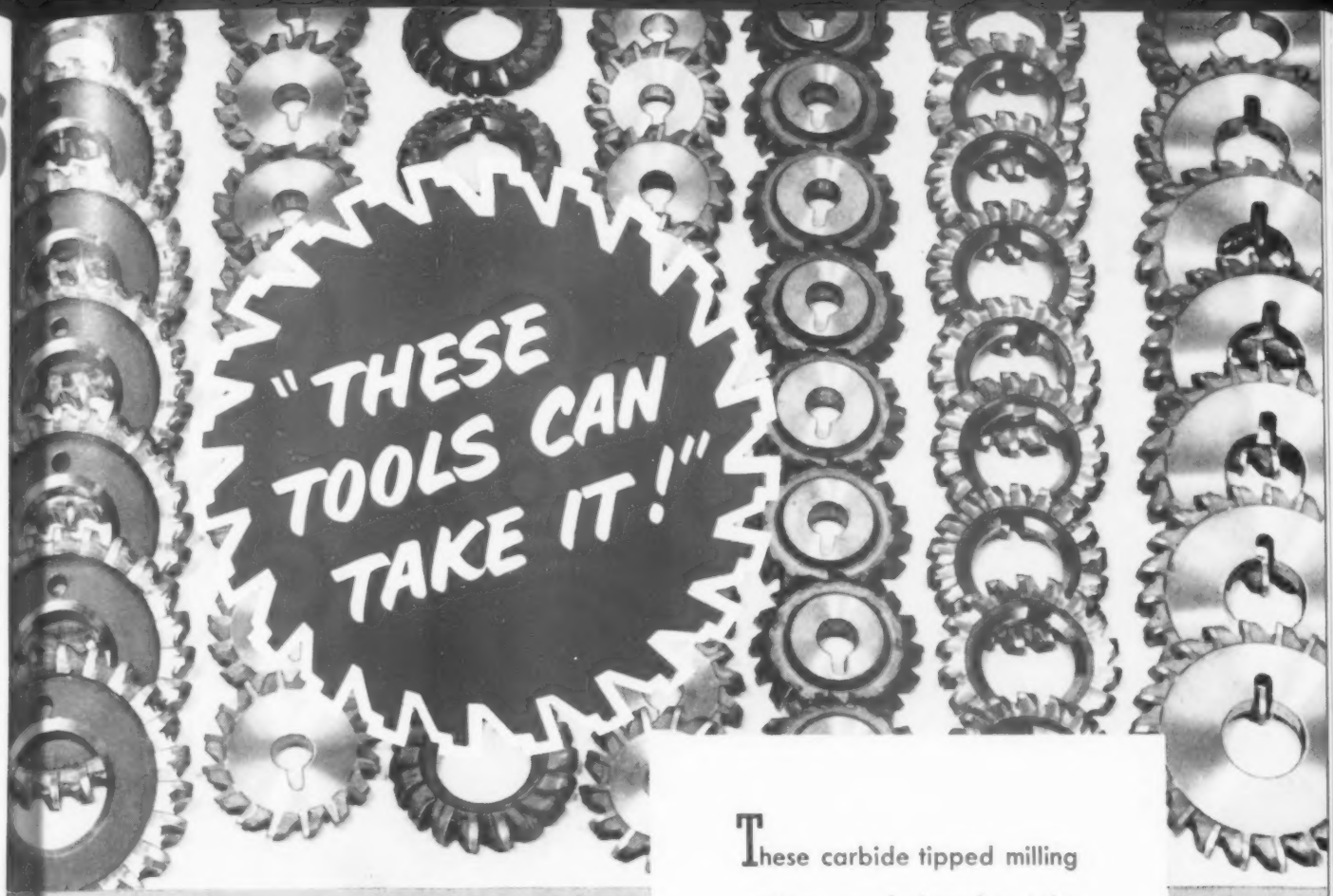
Benco Pushers always feed smoothly and uniformly without damaging the stock. Selected bar stock, precision machining and accurate heat treating assure long-lasting, trouble-free operation. Thread tolerances are carefully checked to insure proper fit in the feed tube.

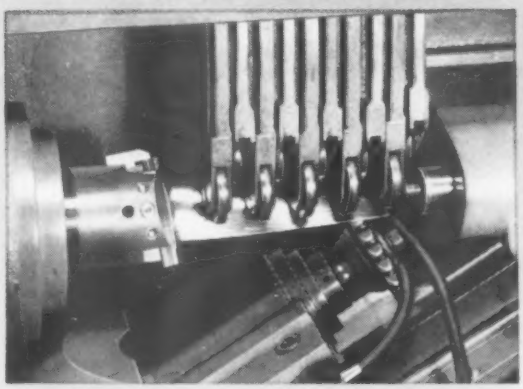
Benco makes many types of pushers . . . solid, squirrel cage, heavy-duty cage type, Multi-Split and Master with alloy pads. Benco Pushers have all the qualities that make for smooth production on long or short runs. Test them in your machines and you'll quickly see why they are superior to ordinary pushers!

BENCO COLLET MANUFACTURING CO.

1560 EAST 27th STREET CLEVELAND 14, OHIO

Always Better Constructed Accurate Benco Collets, Pushers and Pads





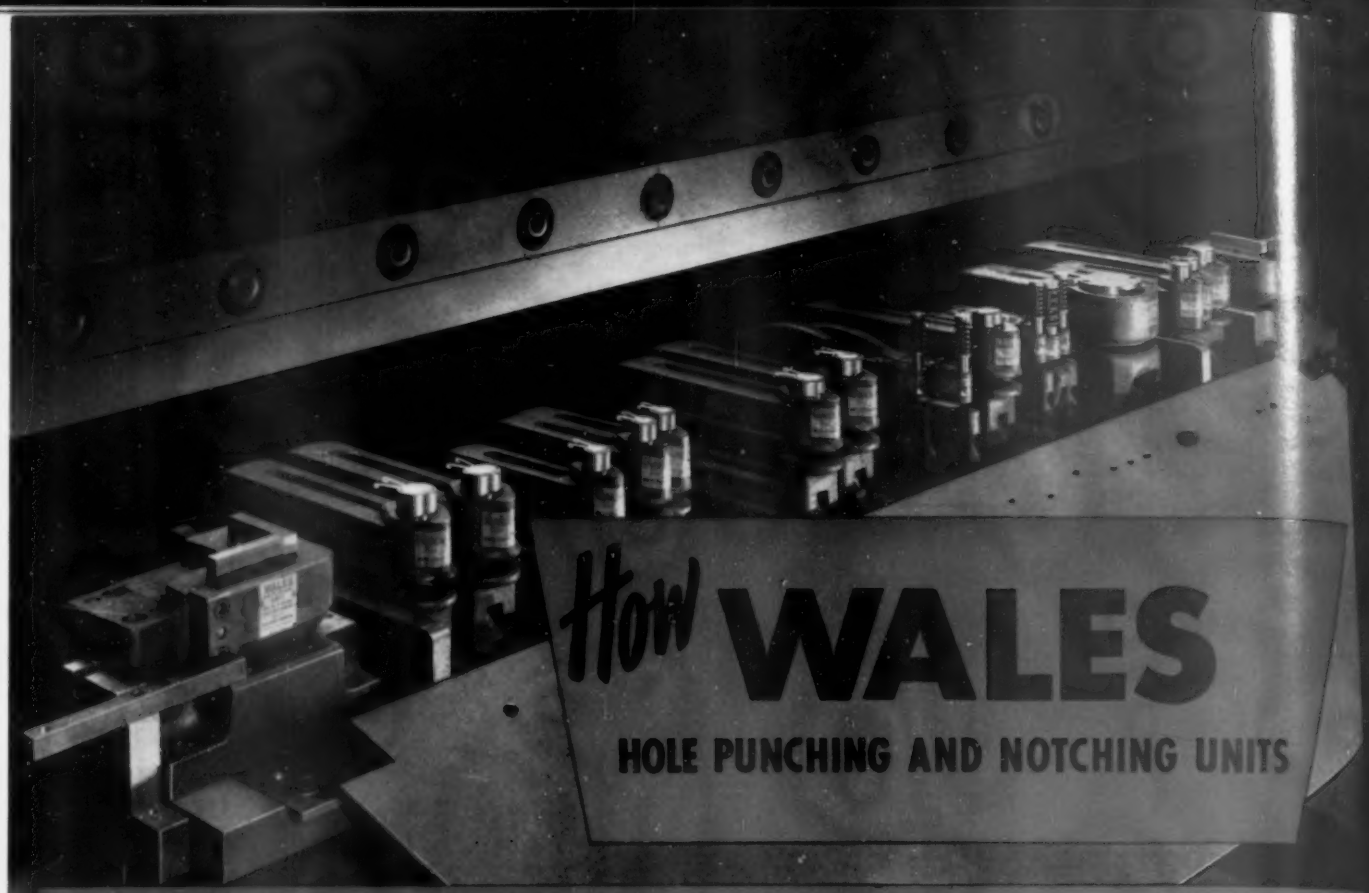
Close-up of a jet aircraft blade and Continental cutter on Ex-Cell-O Style 86 Precision Profile Miller.

These carbide tipped milling cutters are designed to take heavier cuts in stainless steel. This feature reduces glazing or work-hardening commonly experienced with conventional cutters. They're manufactured by Continental and used on profile millers for jet aircraft blades. If you are machining jet blades, or have any other job on which "performance-proved" tools can be used, get in touch with Continental or call in your local Ex-Cell-O representative.

Continental
TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

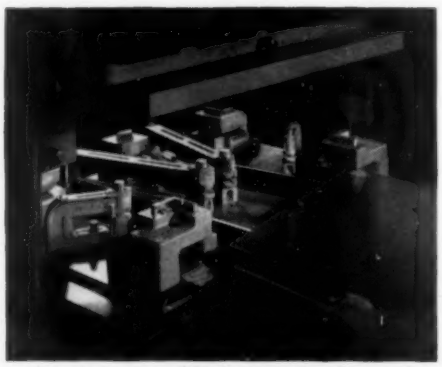
DETROIT 32, MICHIGAN



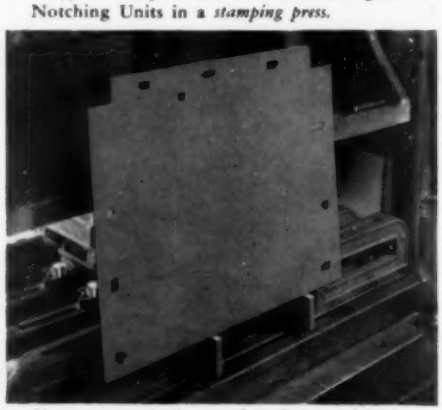
How WALES

HOLE PUNCHING AND NOTCHING UNITS

A typical *press brake* setup of Wales Hole Punching and Notching Units.



A typical setup of Wales Hole Punching and Notching Units in a *stamping press.*



Showing typical round and shaped holes punched by Wales Hole Punching Units. Note corners have been notched by Wales Notching Units.

MAKE FASTER, MORE ECONOMICAL SETUPS IN STAMPING PRESSES AND PRESS BRAKES

. . . *By eliminating* the time consuming operation of ali ing each set of punches and dies.

. . . *By eliminating* special punches, punch plates, strip plates, die buttons and die plates.

. . . *By eliminating* "dead storage" of setups and tooling vestments—Wales Units drastically reduce setup and p duction time plus cutting initial and operating costs.

These tooling efficiencies are made possible by the *exclu* independent, self-contained design that holds all work parts as a single hole punching or notching unit. A gro of Wales Units may be set up in unlimited patterns and many cases, put into operation the same day a pattern released for production.

For the complete story on this faster, more economi production technique that has revolutionized tooling pr tice, write TODAY for fully-illustrated, functionally-colo Catalog BL and Catalog N.

WALES-STRIPPIT CORPORATION

George F. Wales, *Chairman*
5V5 PAYNE AVE.
(Between Buffalo and Niagara Falls)
Wales-Strippit of Canada, Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment